KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. IV. FEBRUARY, 1881. NO. 10.

PHILOSOPHY.

THE NEW HYPOTHESIS.

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The mind of man is so constituted that it is not content with mere formula, but is always searching for facts. Each new discovery is but a point of departure in the ultimate inquiry, whence are we? And while this question has been the one of all ages and of all research, it remains unanswered. It is unlike that other universal question: "If a man die shall he live again?" the answers to which are as voluminous as religions and supernatural literature. Upon this question rests the ecclesiastical structures of the world in all ages, as well as the occult teachings of the mystics of every degree in all time. Its affirmation is woven into all systems of jurisprudence and underlies the laws of all civilized nations, as well as the customs of barbarous races and tribes of men. That it is not proved by methods that afford demonstration matters not; mankind rests upon it to-day, always has so rested, and it is but logical to conclude, will make it the one fundamental idea of their moral government while humanity endures.

The question of life, however, is treated from a different standpoint, and, depending less upon mere dogma, its solution has been sought by scientific methods; facts have been found from which hypotheses have been born, and the rules of philosophic induction applied to discover the secret. Or, in other words, the origin of life has been sought by physical research and the physical basis of life has become a thing of the schools. This may be called the modern method, for it has only been possible since chemistry and the microscope have been the familiar agents of investigation. Much of the literature of science has

been misdirected, in that in addition to its search for facts it has used those facts in a controversial sense, as against dogma—as if it made any difference to the fact what dogma taught. It does not change the fact of existence or destination one way or the other whether dogma be right or wrong—the result of the fact is purely intellectual freedom.

It matters not to knowledge whether dogma preaches a delusion, and it is a mistake in science, while denying to dogma the right to make a god, to copy its assumption by making him through a furnace or defining his attributes through optics. God-making is the by-path in all times that has led aside from the royal highway of knowledge, and the disciples of science can only follow it to the failure of their true mission.

In a former paper which I had the honor of reading before you, about life theories, after summing up all that had been then discovered, the result was given in these words: "There is no physical basis upon which a knowledge of how life came can rest. So far as those who assume to answer for science, there has been no answer." And the same must be said to-day. Since then much has been written, but no change in the verdict. The declaration of Tyndall still stands: that there is nothing living that did not derive its life from a pre-existing living thing. And M. Quatrefages, the most eminent of anthropologists, in a work since published, sums up the result of his life's labor, of his investigations and those of his co-laborers in this special field, in the all conclusive declaration: "I do not know."

Still the inquiry goes on, and the best minds in science, the most skilled in special investigation are as unceasing as ever, and the work of interrogating nature goes forward with zeal unabated and with vigor unrelaxed. The question of method is now the one that engages most attention, and what we may call the new hypothesis is that to which the highest skill and choicest learning are devoted.

In science, as in everything else, the phenomena of the human mind are manifest. We find those who are prone to rest on every new fact as final and covering the limit of what is knowable—counterparts of what we call the "conservative" in social Science. Newton never supposed that he knew everything, yet there are multitudes who think he did, and these are always pulling back on the wheels of progress and new discovery. And it is these men who cry out: "away with hypothesis, give us facts," while all that Newton ever discovered was the fruit of hypothesis. Science to-day is but a grain of fact in a measure of hypothesis, and our scientific literature is a volume of hypothesis from a chapter of facts. Hypotheses are to science what fertilizers are to the soil—the cause of the crop of fact.

One of the greatest obstacles to the presentation of philosophic truth is the necessity of using names, since the words employed to express abstract ideas of conditions by the mere force of repetition come to be associated in the mind as tangible things, and form a sort of intellectual furniture, only to hinder the clear conception and expression of things that have no tangibility, and, to be clearly understood, must be thought of aside from any material comparisons.

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Thus, when we think of gravity, we call it a law, when it is only a conception of a state or relation between parts of a whole, that we call the universe. And there is connected with the word law a finite, a restricted idea, whi h, borrowing a coloring from our own methods, dwarfs the impression of its infinity, its eternity and its expression. We cannot dissociate the idea of its governing the movements of worlds, when it is only part of the universal whole which cannot be suspended, as there never has been a time or a conception of a time when it was not—because gravity is creation. We speak of matter under the same disabilities, and one of the most difficult things for the mind to do, and we might say impossible for it to do, is to think of matter without the association of something that is tangible to the material sense, something that has substance, form and dimension, whereas matter is only the name of the tool for handling an idea. We know matter is not the thing we associate it with in the mind, for there is no form of visible matter that, by methods known to us, cannot be made to disappear from all sense. We can attain to an intellectual recognition of matter in this conception, measurably, but as soon as we attempt to speak of it, the forms of speech dissipate the true conception again. This disabling obstacle interposes in all discussion from facts, and intrudes the physical basis of life as a theory, when in the nature of things, as we understand the word, there can be no such thing as the physical basis of life. To deal with the subject at all, we must do so by hypothesis, and the use of facts is to illustrate or to approve or disapprove the theory advanced. And why not?

Take for example the theory of evolution, to which the school that assumes to be pre-eminently scientific seems to hold as the ultimate of science in the direction of the origin of life. It is not fact, but only a hypothesis based on a hypothesis. The entire structure of materialism and its science, as related to the origin of life and the development of living things, rests on the nebular hypothesis. If that should be discovered not to be well founded, not only evolution, but many other far more generally received theories and systems would fall with it. Is it not then best to be respectful to hypothesis?

And just here allow me to digress and to make an observation pertinent to the argument to follow. It has always been a mystery how the advocate of the physical basis of life, or the materialist, can ignore the oneness of matter and the hypotheses that follow that idea, when the very foundation, the central fact upon which his entire theory rests, is that the solar system, the eternal basis of all things in his system, was at one time nothing—a mere expression—void. If it was so before the beginning, why not so now? Did the evolution into the nebulæ, and from the nebulæ into worlds necessarily change the original order of all matter in space? We know it has left an atmosphere as intangible, when at rest, as vacuity itself, and why not have left space still more ethereally occupied? In fact it has been negatively demonstrated that space is pervaded by a medium that transmits light, heat, and what we call the chemical rays of the sun. What are these chemical rays? Why not this very principle of life that we are in search

of, and which, from a wrong conception as to matter, has lain, so to speak, under our very feet for all the ages? The universe is not a thing, a machine, made for us to look at and wonder how we would have gone to work to make it, but we are part of it, as actually as though we were a planet or a rock. We are but an expression of matter, as the rock or the tree; our bones and tissues are but expressions of matter, yet they have assumed form and substance, so far as our methods of inquiry go, from the same source that comes the faculty that describes them. But they are not necessary for life, as life exists without them, but they are necessary to the uses of the life that employs them. And here again we come to the inquiry which humanity has always been making.

And here, once for all, it may as well be said, that the "origin" of life is a misnomer, an assumption. The true philosophic inquiry is, how and when did life, as we know it or as we understand it, manifest itself upon our earth, and how? For the origin of life is with the infinite, and we cannot even form a conception of its beginning; it may never have had an origin. It may be the eternal principle itself, without beginning or ending, and knowable only by itself. It is egotism for humanity to assume itself the one perfect manifestation of life. We may be as low in the scale compared with other forms as are the merest rudimentary organisms of our own planet. Let not then this egotism overtask our powers of conception. It is enough, and to us godlike, to study its manifestations and to trace its processes as far only as the ultimate forms of matter and its phenomena may enable us to understand this principle, which to the universe of soul and sense is as that of gravity to the universe of material worlds.

We are now engaged in a new line of inquiry. When science began the study of the problem of life, it commenced at the foundation of things, the formation of the solar system, and thence to our house, the planet which we inhabit. The theory of the rocks grew from the nebular hypothesis, and the examination of the rocks supported the theory. The fossils in the rocks told the story of a once differing form of life to ours, of many epochs of differing forms, and so grew demonstration out of theory. That book of the rocks has been variously read, the last reading being by the light of comparative anatomy, until the hypothesis of spontaneous generation and evolution became the solution of science. But it has not so far, stood all tests. Thus we read up from the past, and we have the advantage of the wondrous store of knowledge obtained. If not conclusive, the mind of man is immensely the richer in its possessions for it.

The present method, however, is entirely different. It is from small things—going up from particles to aggregates and systems. We take now, instead of a stratum of rock, a molecule, and we learn its lesson. And this lesson is that all life is in its phenomena and appearance the same—whether of plant or animal. There is no difference in the appearance or action of the molecules of an oak and of a man. And so far as we can determine this little mass actually performs the work of growth as perfectly, and seemingly as intelligently, as does the bee its material work. So far as we can see it works consciously and with intelligent plan, pur-

pose, and as we know, to uniform results. We call all this "force," but it is only a confusion induced by the necessity of words. In our mechanical contact with material objects, that we employ to control them we call force, and so in the barrenness of physical speech we apply the same term to this work of the creative energy, and this manifestation of an eternal and infinite purpose. But in the case of a tree we find the same as in that of the bones—the trunk, the wood, the bark and the leaves are forms of matter, but they are not necessary to the perpetuation of the life of the tree—that is in the seed. What is in the seed? That is just what we have never been able to discover. Here lies the mystery, and if we cannot grasp its presence, why try before we gain that secret, to question it as to its origin?

Now let us turn to a wider field. Many years ago the furnace and retort of the chemist found certain substances that were obdurate and refused to obey certain so-called laws that other substances did obey. These were called elements, and they were called so as forming the original substances of our world. Then came the discovery of the spectroscope, and it was found that some of these elements, many of them, existed in the sun. Then came the hypothesis, or scientific deduction, that the sun, earth and all the family of the solar system were of like composition—the same elements of matter. It is strange that with the nebular hypothesis as the basis of the solar system, this fact had not been accepted before. It is hard to conceive how it could be otherwise, if we place law over all. But is it not equally strange, that the other presumption was not considered? that as all were once mere nebulæ, that as the matter composing sun and worlds was in different states than in the beginning, that these differing states were only the different aspects of the same original nebulous mass; and it is still more strange, when we reflect that science held all the time to the theory of atoms and knew the law of atomic combination. The world had not then, nor has it now, got beyond the idea of matter, that it is something you can eat or kick.

But after the spectroscope came, the men with hypotheses began to investigate, and they found one line merging into another, one part, for example, of the sun's rays or atmosphere, or what they may be called, gave less lines or elements than another, until at one culminating point in the wondrous laboratory of our central orb, all disappear but the hydrogen line; or that all forms of matter, all elements, are but differing conditions of hydrogen. Still there are men, who having followed the study of matter from the supposed simples of the elements of our globe, up to this generalization of all substances into one, who yet deny the inevitable conclusion—the unity of matter. It is this class of conservatives who have placed, always, the barriers and finalities to knowledge, who seem afraid to face the tremendous fact that these discoveries suggest. And here they stop, and instead of a god of fossils and evolution, they make a hydrogen god, and shut the door in the face of the hypothesis, that there is still a God beyond the veil of hydrogen; that matter is still capable of a condition beyond that burning atmosphere which has absorbed all known forms of matter into its own.

But it may be asked in view of this criticism: Are we to give up scientific

research in this direction ? By no means, for science is surely tracing out the path of inquiry that leads in the direction of the unknown. What is complained of, is that its disciples are too prone to stop at each step in advance, as if there was nothing beyond. Or it may be stated in another form : Science has so long combatted mere dogma, and soo utterly dethroned special providence, miracle and chance, that itself has become timid before the idea of the supernatural, and like the old creed builders who trembled at a fact, these scientists dread anything that suggests itself beyond the forces of the laboratory. They are almost as free to burn a heretic as were their persecutors in the past. If research leads to the border land between science, as we deal with it, and something beyond our methods, we must face it, and follow it as we may.

And now, leaving spectroscopic science on its hydrogen frontier, let us see what has been done in the laboratory. Here the progress has been greater than in the other field, but in the same direction. Of course reference is made to the experiments of Prof. Crookes, in what he calls, after Faraday, "radiant matter." And allow a digression here, for the benefit of those who have refused to accept what they may choose to call the unsupported testimony of Crookes, to say that within the month his experiments have been repeated and the truth of his theory demonstrated by our own great countryman, Henry Draper, before a large number of the members of the National Academy of Sciences.

This radiant, or as it is usually termed, the fourth state of matter, suggests another plea for hypothesis. What has now been demonstrated to the eye is but the proof by experiment of the hypothesis of Faraday, suggested sixty-five years ago, so that it cannot be said to be entirely new, but which men who did not want to think or who could not think, have ever since regarded as a vagary of that great mind. The formula for matter has been solid, liquid, gaseous, and to these Faraday had added radiant. Now science took no note, when it rejected this fourth condition, of the fact that it had stopped for a long period at the dual character of matter—solid and fluid—and that the gaseous was only a comparatively modern innovator. Still this did not prevent an incredulous, not to say a pitying, sympathetic smile, at this vagary of Faraday. Yet despite the still slow acceptance of it, it is a fact, proven to the eye before the British Association for the Advancement of Science, the French Academy and, as noticed above, before our own American Society.

It is not the purpose here to describe the phenomena attending the experiments that demonstrate the existence of this fourth state of matter; only to note that in some of them the phenomena are in conflict with the accepted laws of matter heretofore recognized as immutable, and that it has different properties from any of the three. It evolves colors, and when intercepted by a solid body casts a shadow; it is deflected from a straight line by a magnet, moves spirally, it exerts mechanical action where it strikes, and produces heat when its motion is arrested.

Now, these phenomena show, some of them, that what the experimenter was

dealing with was matter, for it manifested the phenomena of matter under understood laws, while others show that it has phenomena peculiar to its condition, or which do not manifest themselves to our cognizance in any of the forms below it. Notably is this so as to colors. And by colors is not meant hues, merely, but colors that radiate and illuminate. This is something that no other form of matter known displays; and it casts a shadow. What a startling suggestion.

Now, crossing over from this disclosure of the vacuum tubes, let us take again the spectroscope, and we find that in one sphere of the emanations from the sun or its atmosphere, it bursts, so to speak, into a stupendous zone of color, and which in our barrenness of description is called the chromosphere. Is it then illogical to conclude that the radiant matter of the vacuum tube and the chromosphere of the sun are both but matter in the same state or condition? And thus do we, in strict accord with scientific methods demonstrate the truth of the hypothesis.

Now we get to a state of matter by two processes of analysis that present the same phenomenon—color—and we are for the first time, by physical methods, compelled to admit color into the family of entities, things, elements, or forces. Here then by regular methods of practical science, we are face to face with something heretofore unrecognized and uncatalogued, and we must take a new departure in investigation. We have reached a new continent and must push our explorations from a new base of observation, and with a new element of interpretation.

As yet we have discovered nothing that contradicts the atomic theory, and all these experiments as to radiant matter are based upon that theory and all results are in harmony with it. Then we conclude that in one state or relation or combination of atoms, the result is color, and that modifications of color are only variations, so to speak, of the normal relation or state of atomic combination that produces color; these colors of the vacuum tube, in one case, and the supreme glory of the chromosphere in the other. And now what?

As this refined condition of matter must be before colors become its expression, does not this refined matter interpenetrate everything and thus give to grosser matter, mineral, vegetable and animal, what we call their permanent tints, by which we read their nature as we read a book? And is not this refined matter but an expression of one of the phenomena of life, without which life cannot be? It must be so.

And now, with these two states of matter, or rather matter reduced by the two methods of investigation to a condition that discloses not only its homogeneous property, but its attenuation to a millionth part only of the density of air, what does it suggest? We refer next to the facts recited in the last paper already referred to, as disclosed by the microscope: that the molecules of living matter in the organisms of living beings, are simple, formless, colorless particles, that obey no known physical law, but as from some unknown source of power and store-house, build up the organism from a mere dimensionless point, endowed

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with a force and function that had no knowable origin or cause. Why not find it here in this condition of matter so ethereal in its refinement as to baffle the mind in its effort to realize it, but having a force to which nothing ponderable can be compared? Or, if even this, as we have tested it, is too crude to respond to the uses of the complex and wondrous thing we call life, why not follow it still farther to a yet more exalted state, through which the divine essence may quicken the forms of matter by which we recognize the phenomena of life? Is this hypothesis any more strained from the point of to-day than was that of Faraday from that of sixty-five years ago, with the testimony of both spectroscope and microscope added? Or must we, like the worshippers of the fossil god and the hydrogen god, set up this radiant molecular image and worship it, until some daring investigator with new appliances breaks the image and advances us another step in physical facts.

Our lame methods of illustration at best give but an unsatisfactory idea of the immense force and activity of this matter in the radiant state, but Flammarion's words may help in a degree to its realization. Speaking of Crookes' experiments before the French Academy, this eminent authority says: "The ball which Mr. Crookes uses, of four inches diameter, when exhausted to one-millionth of an atmosphere, still contains a quintillion of molecules, and its capacity a septillion. Now, pierce this globe with the aid of an electric spark, which traverses it through an opening entirely microscopic, nevertheless sufficient to permit air to enter it. If in this opening the molecules enter at the rate of a hundred millions per second, it would require more than four hundred millions of years to fill the ball, yet it is actually filled in an hour through the microscopic opening." The mind cannot grasp such numbers, nor is it flexible enough to sense such infinitely small particles. But it enables it in some degree to imagine the force, activity and power of matter in its ultimate forms, and to satisfy the mind that life, through the still larger comparative masses of protoplasm, as quickened by this inconceivable energy, is possible.

Here, then, we find the basis for a new hypothesis as to life, not as to the origin of life; for that lies still behind, but as to the union between life and organic development, for here all seeming necessary conditions meet, and we can conceive how such tremendous and exalted forces, operating through this plastic material, may create the environment for the production of living phenomena. It seems indeed as if here must end the inquiry into the phenomena of life in this direction, as it is difficult to imagine how a farther refinement of matter by physical methods is possible, or how it could aid what appears so clear —that life as we see it must thus find its expression through organic forms. We have followed it with sure footsteps to this border land, and we know it cannot come in any other way. So far the hard demand for facts has been met. This much seems to have been necessary for physical science to do, for without it superstition, dogma, or credulity had no limit; the infinite was simply chaos, stirred by any vagrant force that, surrounded by its own agitation, called itself

the all. But this has given a basis on which the mind can rest and from which reason can reach out toward the final cause; it has led us to the shores of the mysterious ocean, upon which the explorer may launch his barque, with the compass of ultimate facts to direct his voyage in search of the still unknown. If life is from the gestation of nature, here is the point from which to question her. If being, consciousness, and the immortal longing of humanity is from the ever living source of the great first cause, here is where the quickening power is first manifest, and from which we must reach out and find food to satisfy that infinite hunger which has ever been the burden of the soul. It cannot be found by following in by-paths, only by traveling the road as it lengthens beyond.

The inquiry is very old: "Who by searching can find out God?" And it is as apt to-day as then. Searching by analysis can never discover Him, nor can it satisfy the reason or the imagination. It can dispel illusion, expose fallacy, confound dogma and instruct faith, because it can show what is not and what cannot be. But analysis is always negative; it does not create, only explains what is created. The higher knowledge comes from the synthetic; it takes up these parts from the hand of analysis and with them builds the tower of wisdom, whose summit basks in the sunlight of infinite truth. And by this method, "the immortal white flower of all reason," we may cross this border land and explore that which is still hidden.

In all that has been seen, there is not a suggestion of evidence that matter itself is life—it is only the medium of a force that as yet has evaded all challenge by our methods, of its presence. But what is it that like an open book lies before us, from the rudimentary rock to the inconceivable forces of matter in these ultimate forms? It is that there is a dual principle, an active and a passive; that the one controls, molds, quickens, and the other responds, adapts, lives. This fact is ever present, as constant as law—it is the law.

If, then, there is, as all fact demonstrates, this dual force, there is one more refined which constitutes life, and must have a kindred force or energy by which it can manifest itself in the world of organized forms. And here is where it meets matter in the dual office; here is where, in other words, life marries matter for the uses of the infinite in the worlds of created substance throughout the universe. It cannot be otherwise. We must here find the heart of the great mystery.

And, now, by the light of these new facts, and the suggested hypothesis, how beautiful do the processes of nature become, joined as it is by its own ultimate states to the sources and quickening forces of the infinite. Matter assumes a new beauty, the beauty of use. The æsthetic sense is no longer repelled by the crude suggestion that the flower, a rose and its perfume, is only matter, for it can understand the wondrous work of these invisible forces that from the intangible air distils such marvelous odors and from the rains and dews evolves the wondrous fabric of the rose leaf and its color. It feels that matter as we see it, as we feel it, is only the garniture of the soul within, that loves it for what it expresses. It feels that it is but the very dross of materialism, born of this material sense, to

make the faculty of mind, consciousness, imagination and soul but the accident, the factory work of mere physical phenomena, which is by courtesy called law. And science, though it may never solve the mystery of life, has by these later discoveries, forever overthrown the hideous nightmare which in its name has been brooding over the human soul and crushing out its aspirations, toward the immortal and unknown, by the benumbing weight of materialistic annihilation; that the soul of man was but a phantom of chemistry that expired with the fires of its containing crucible. Because, what from its minutest form and phenomena to its aggregation in worlds and systems of worlds is all under law and controlled by cause, cannot itself be without cause. This must be, or mind is causeless and without existence. How that cause works to produce life is what we are in search of, and the hypothesis that is sustained by the facts must be the true one.

We must, then, in the light of these discoveries, revise the methods of discussion, dismissing the old questions and formulæ, for they constitute a point of departure back of which the dogmas of the schools are useles. The materialist must revise his theories, for he can no longer borrow from the geologist, nor fortify himself from the earlier teachings of the astronomer. The sun is no longer a mere furnace, stoked by meteors and cometic fuel; this old earth of ours is no more a mass of cooled slag, nor is space a void where eternal cold is only disturbed by the swift rush of planets as they swing their eternal round, the first worshipers of the inevitable fire that will go out when all are consumed. The evolutionist, too, must seek elsewhere than in the festering ferments of primeval slime for that divine spark, which first chambered in a sponge now questions the mysteries of the first cause from this borderland between the living and the life; that has laid its hand upon the forces that grasp the solar system and keeps the stars and worlds in their places; that finds in space the same materials that compose the rocks, the water, the air, and that makes planet responsive to planet, each giving and receiving that which in common phenomena proclaims them all akin. He must find, not a life animal and vegetable alone, existing where all else is dead, but a universe instinct with a life far beyond that of any of its parts, of which our life on this little globe is but a result, a mere expression of the all pervading source of life from which the worlds were born, and in which the universe exists.

Prof. E. S. Holden, of the Naval Observatory at Washington, has accepted the managership of Washburn Observatory at Madison, Wisconsin, made vacant by the death of Prof. Watson, and will enter upon his duties within a few weeks.

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GEOLOGY AND PALÆONTOLOGY.

THE ANTIQUITY OF MAN AND THE ORIGIN OF SPECIES.

PRINCIPAL J. W. DAWSON, MONTREAL, P. Q.

(*Concluded.*)

To return to primitive man and the date of his appearance in Europe, an important question is raised by Dawkins in the attempt which he makes to discriminate between two races of men supposed to have existed successively in Europe in postglacial times or in the Second Continental period. These he calls respectively "men of the river gravels" and "cave men." The idea of such distinction seems to have arisen in his mind from the fact that in certain caverns in England the lowest stratum containing human remains affords only rude implements, while an upper stratum appears to testify to improved manufacture of stone tools and weapons; both strata being of so-called "paleolithic" age—that is, belonging to the time when certain mammalia now extinct survived. Such facts, however, would rather seem to testify to local improvement in the condition of certain tribes than to any change of race. Such local improvement would be very likely to occur wherever a new locality was taken possession of by a small and wandering tribe, which in process of time might increase in numbers and in wealth, as well as in means of intercourse with other tribes. A similar succession would occur when caves used at first as temporary places of rendezvous by savage tribes became afterward places of residence, or were acquired by conquest on the part of tribes a little more advanced, in the manner in which such changes are constantly taking place in rude communities. Yet on this slender foundation he builds an extensive generalization as to a race of river-drift men, in a low and savage condition, replaced after the lapse of ages by a people somewhat more advanced in the arts and specially addicted to a cavern life; and this conclusion he extends to Europe and Asia, finding everywhere and in every case where rude flint implements exist in river gravels, evidence of the earlier of these races. But his own statements are sufficient to show the baselessness of the distinction. He admits that no physical break separates the two periods, that the fauna remained the same; that the skulls, so far as known, present no differences; and that even in works of art the distinction is invalidated by grave exceptions, which are intensified by the fact, which the writer has elsewhere illustrated, that in the case of the same people, their residences in caves, etc., and their places of burial are likely to contain very different objects from those which they leave in river gravels. Perhaps one of the most curious examples of this, referred to by our author, is the cave of Duruthy in the western Pyrenees. On the floor of this cave lay a human skull covered with fallen blocks of stone. With it were found forty canine teeth of the bear and three of the lion, perforated for suspension,

and several of these teeth are skillfully engraved with figures of animals, one bearing the engraved figure of an embroidered glove. This necklace, no doubt just such a trophy of the chase as would now be worn by a red Indian hunter, though more elaborate, must have belonged to the owner of the skull, who would appear to have perished by a fall of rock, or to have had his body covered after death with stones. In the deposit near and under these remains were flint flakes. Above the skull were several feet of refuse, stones, and bones of the horse, reindeer, etc., and "paleolithic" flint implements, and above all were placed several skulls and skeletons with "beautifully chipped" flint implements. After the burial of these the cave seems to have been finally closed with large stones. The French explorers of this cave refer the lower and upper skulls to the same race; but Dawkins, in consistency with his theory, has to consider the upper remains as "Neolithic," though there is no conceivable reason why a man who possessed a necklace of beautifully carved teeth should not have belonged to a tribe which used well-made stone implements, or why the weapons buried with the dead should have been no better than the chips and flakes left by the same people in their rubbish-heaps.

The reasoning by which the author supports this distinction is throughout scarcely worthy of his reputation, and implies great carelessness as to modern analogies. The same remark may be made as to his identification of the cave men with the Esquimaux. What he says on this head would serve quite as well to identify them with other hunting and fishing people; with the Haidas of the Queen Charlotte Islands, for example, the Micmacs of Nova Scotia, or even the Fuegians. He exposes, however, the folly of the minute distinctions made by some French archæologists as to the ages of the remains in different caves, and which, as Lyell and others have insisted, prove no more than slight differences of wealth and culture among contemporary or immediately successive tribes.

Another point on which he well insists, and which he has admirably illustrated, is the marked distinction between the old paleocosmic men of the gravels and caves and the smaller race with somewhat differently formed skulls which succeeded them, after the great subsidence which terminated the Second Continental period and inaugurated the Modern epoch. The latter race he identifies with the Basques and ancient Iberians, a non-Aryan or Turanian people who once possessed nearly the whole of Europe, and included the rude Ugrians and Laps of the north, the civilized Etruscans of the south, and the Iberians of the west, with allied tribes occupying the British Islands. This race, scattered and overthrown before the dawn of authentic history in Europe by the Celts and other intrusive peoples, was unquestionably that which succeeded the now extinct paleocosmic race and constituted the men of the so-called "Neolithic period," which thus connects itself with the modern history of Europe, from which it is not separated by any physical catastrophe like that which divides the older men of the mammoth age and the widely spread continents of the post-glacial period from our modern days. This identification of the Neolithic men with the Iberians,

which the writer has also insisted on, Dawkins deserves credit for fully elucidating, and he might have carried it farther to the identification of these same Iberians with the Berbers, the Guanches of the Canary Islands, and the Caribbean and other tribes of eastern and central America. On these hitherto dark subjects, light is now rapidly breaking, and we may hope that much of the present obscurity will soon be cleared away.

Another curious point illustrated by Dawkins, with the aid of the recent re-discovery of the tin-mines of Tuscany, is the connection of the Etruscans with the introduction of the bronze age into central Europe. This, when viewed in relation to the probable ethnic affinities of the Etruscans with the "Neolithic" and Iberian races, remarkably welds together the stone and bronze ages in Europe, and explains their intermixture and "overlap" in the earlier lake habitations of Swizerland and elsewhere.

We are also indebted to our author for a suggestion as to the linguistic connection of the Neocosmic and Modern periods, which is deserving the attention of philologists. He quotes from Abbè Inchaurpè, the following Basque words:

Aizcora	= Axe	= Stone lifted up or handled.
Aitzurra	= Pick	= Stone to tear asunder.
Aizttoa	= Knife	= Stone, little or small.
Aizturrac	= Scissors	= Little stones for tearing.

He remarks that all these words are derived from the word *aitza, atcha,* stone, though now applied to implements of metal. The same thing occurs in many American languages, in which the word for stone, with appropriate additions, is applied to different kinds of tools. It is also curious that in some of the American languages the word for stone is almost identical with that in Basque; but this applies to some other Basque roots as well. Still it is not unlikely that the onomatopoietic sounds, *itz, aitz* and the like, applied to stones and cutting instruments in many languages, in all cases arose from the use of sharpened stones in cutting and rending.

A still more important speculation arising from the facts recently developed as to prehistoric men is the possible equivalency with the historical deluge of the great subsidence which closed the residence of paleocosmic men in Europe, as well as that of several of the large mammalia. Lenormant and others have shown that the wide and ancient acceptance of the tradition of the deluge among all the great branches of the human family necessitates the belief that, independently of the biblical history, this great event must be accepted as an historical fact which very deeply impressed itself upon the minds of all the early nations. Now, if the deluge is to be accepted as historical, and if a similar break interrupts the geological history of man, separating extinct races from those which still survive, why may we not correlate the two. The misuse of the deluge in the early history of geology, in employing it to account for changes that took place long before the advent of man, certainly should not cause us to neglect its legitimate uses, when these arise in the progress of investigation. It is evident that if this

correlation be accepted as probable, it must modify many views now held as to the antiquity of man. In that case, the modern gravels spread over plateaus and in river valleys, far above the reach of the present floods, may be accounted for, not by the ordinary action of the existing streams, but by the abnormal action of currents of water diluvial in their character. Further, since the historical deluge cannot have been of very long duration, the physical changes separating the deposits containing the remains of paleocosmic men from those of later date would in like manner be accounted for, not by slow processes of subsidence, elevation, and erosion, but by causes of more abrupt and cataclysmic character. This subject the writer has referred to in previous publications,* and he is glad to see that prominence has recently been given to it by so good a geologist as the Duke of Argyll, in a late number of the *Contemporary Review*.

It is a great leap backward to pass from the bronze age of Europe to the Paleozoic brachiopods of Bohemia; but both may furnish illustrations of the same natural laws, as both belong to the same long-continued creative work. Barrande, like some other eminent paleontologists, has the misfortune to be an unbeliever in the modern gospel of evolution, but he has certainly labored to overcome his doubts with greater assiduity than even many of the apostles of the new doctrine; and if he is not convinced, the stubbornness of the facts he has had to deal with must bear the blame. In connection with his great and classical work on the Silurian fossils of Bohemia, it has been necessary for him to study the similar remains of every other country, and he has used this immense mass of material in preparing statistics of the population of the Paleozoic world more perfect than any other naturalist has been able to produce. In previous publications he has applied these statistical results to the elucidation of the history of the oldest group of crustaceans, the trilobites, and the highest group of the mollusks, the cephalopods. In his latest memoir of this kind he takes up the brachiopods, or lamp-shells, a group of bivalve shellfishes, very ancient and very abundantly represented in all the older formations of every part of the world, and which thus affords the most ample material for tracing its evolution, with the least possible difficulty in the nature of "imperfection of the record."

Barrande, in the publication before us, discusses the brachiopods with reference, first, to the variations observed within the limits of the species, eliminating in this way mere synonyms and varieties mistaken for species. He also arrives at various important conclusions with reference to the origin of species and varietal forms, which apply to the cephalopods and trilobites as well as to the brachiopods, and some of which, as the writer has elsewhere shown, apply very generally to fossil animals and plants. One of these is that different contemporaneous species, living under the same conditions, exhibit very different degrees of vitality and variability. Another is the sudden appearance at certain horizons of a great number of species, each manifesting its complete specific characters. With very rare exceptions, also, varietal forms are contemporaneous with the normal form of their specific type, and occur in the same localities. Only in a very few cases

* "Origin of the World," Fossil Men."

do they survive it. This and the previous results, as well as the fact that parallel changes go on in groups having no direct reaction on each other, prove that variation is not a progressive influence, and that specific distinctions are not dependent on it, but on the "sovereign action of one and the same creative cause," as Barrande expresses it. These conclusions, it may be observed, are not arrived at by that slap-dash method of mere assertion so often followed on the other side of these questions, but by the most severe and painstaking induction, and with careful elaboration of a few apparent exceptions and doubtful cases.

His second heading relates to the distribution in time of the genera and species of brachiopods. This he illustrates with a series of elaborate tables, accompanied by explanation. He then proceeds to consider the animal population of each formation, in so far as brachiopods, cephalopods and trilobites are concerned, with reference to the following questions: (1) How many species are continued from the previous formation unchanged? (2) How many may be regarded as modifications of previous species? (3) How many are migrants from other regions where they have been known to exist previously? (4) How many are absolutely new species? These questions are applied to each of fourteen successive formations included in the Silurian of Bohemia. The total number of species of brachiopods in these formations is 640, giving an average of 45.71 to each, and the results of accurate study of each species in its characters, its varieties, its geographical and geological range, are expressed in the following short statement, which should somewhat astonish those gentlemen who are so fond of asserting that derivation is "demonstrated" by geological facts:

1. Species continued unchanged	28	per cent.
2. Species migrated from abroad	7	"
3. Species continued with modification .	0	"
4. New species without known ancestors.	65	"
	100	per cent.

He shows that the same or very similar proportions hold with respect to the cephalopods and trilobites, and in fact that the proportion of species in the successive Silurian faunæ, which can be attributed to descent with modification, is absolutely *nil*. He may well remark that in the face of such facts the origin of species is not explained by what he terms "les élans poétiques de l'imagination."

The third part of Barrande's memoir, relating to the comparison of the Silurian brachiopods of Bohemia with those of other countries, though of great scientific interest and important in extending the conclusions of his previous chapters, does not concern so nearly our present subject.

I have thought it well to direct attention to these memoirs of Barrande, because they form a specimen of conscientious work, with the view of ascertaining if there is any basis in nature for the doctrine of spontaneous evolution of species, and, I am sorry to say, form a striking contrast to the mixture of fact and fancy on this subject which too often passes current for science in England,

America, and Germany. Barrande's studies are also well deserving the attention of our younger men of science, as they have before them, more especially in the widely spread Paleozoic formations of America, an admirable field for similar work. In an appendix to his first chapter, Barrande mentions that the three men who in their respective countries are the highest authorities on Paleozoic brachiopods, Hall, Davidson, and De Koninck, agree with him in the main in his conclusions, and he refers to an able memoir by D'Archiac in the same sense, on the cretaceous brachiopods.

It should be especially satisfactory to those naturalists who, like the writer, have failed to see in the paleontological record any good evidence for the production of species by those simple and ready methods in vogue with most evolutionists, to note the extension of actual facts with respect to the geological dates and precise conditions of the introduction of new forms, and to find that these are more and more tending to prove the existence of highly complex creative laws in connection with the great plan of the Creator as carried out in geological time. These new facts should also warn the ordinary reader of the danger of receiving without due caution those general and often boastful assertions respecting these great and intricate questions, made by persons not acquainted with their actual difficulty, or by enthusiastic speculators disposed to overlook everything not in accordance with their preconceived ideas.—*Princeton Review.*

THE PLIOCENE BEDS OF SOUTHERN OREGON.

BY CHAS. H. STERNBERG.

In the year 1877, while at work in the fossil fields of Western Kansas, I received orders from Prof. Cope, in whose employ I was, to go at once to a new locality, discovered in the Desert of Southern Oregon and said to be very rich in fossil remains. A few days were sufficient to make all needful preparation, and I was on my way by rail through the grand and impressive scenery of Weber and Echo Cañons of the Rocky Mountains. Among the towering peaks of the Sierras, by stage, past Castle Rock and old Mount Shasta, in California, and on to Fort Klamath, Oregon, where I procured pack animals and hired an assistant. After various adventures I reached Silver Lake, near which I expected to find the bone yard, as the people called it. A guide led us through an alkaline desert covered with sage brush and greasewood. A journey of twenty-eight miles brought us to a small alkaline lake, on the margin of which lay the remains of extinct animals, on a bed of clay, all exposed. The volcanic ashes and sand that had covered them had been blown away. As night was fast approaching when we reached the fossil field, we gathered a huge pile of sage brush, pitched our tent, and soon had a comfortable fire, and after a hearty meal, we stretched ourselves on our blankets and listened with lighted pipes to the stories of our guide; and hough we were twenty-eight miles from human habitations, and in spite of the

howling of the wolves, we made ourselves comfortable. In the morning we were early astir, and during the day made the largest collection of fossil bones I ever got in the same length of time. They were in a fine state of preservation. One unfortunate thing was the absence of perfect skeletons. The skulls had been broken to pieces, doubtless beneath the feet of herds of antelope and deer, that came daily to the lake for water. Teeth, limb bones and vertebræ were common. We found great quantities of fish bones, which were usually detached and represented animals from the size of a trout to a large salmon. About two thirds were of existing species. Birds, also, were abundant, in size from a sandpiper to a stork. They were all of existing species. Great piles of *Planorbis* and other species of fresh water shells looked like snow drifts. Among mammals the horse and llama were most common, three species of each. *Equus major* was as large as our American stock, though with rounder limb bones. *E. occidentalis* was about the size of a small Indian pony. Of the Llama the species were *ancherria hesternia*, *A. major* and *A. vitakeriana*. Specimens were found of a great sloth, *Mylodon*. *Elephas primigenius* left its bones in profusion. They were usually broken, especially the tusks. A few days exploration convinced me that great numbers of animals had been destroyed at once, and an examination of the volcanic sand and ashes that had covered them proved that they had sought shelter from a fierce storm of sand and ashes, from an active volcano in the vicinity, and beasts of all descriptions forgot their natural instincts, and rushed together to the cooling waters of the lake. The gigantic elephant, the horse, llama, deer, wolf and other smaller animals awaited with fear the storm that must overtake and bury them beneath the accumulating *debris*.

One reason for this opinion is the great profusion of remains around the lake. Another is that only isolated bones are found at a distance, showing where some animals had been overtaken by the storm before it reached the lake. What a commotion there must have been on that fearful day, when all the beasts of Southern Oregon found death and burial. Great piles of sand and ashes are found near the lake, carried there by the wind, into which ones horse sinks a foot or more. Among these heaps of sand I found an old Indian village, with old mortars and pestles lying around. Also numerous arrow and spear heads of obsidian. Here and there were heaps of obsidian chips, showing where the old arrow makers had had their shops. Who knows but what man was a witness of the scenes we have described, and perished amidst the storm of burning ashes.

THE QUATERNARY OF WASHINGTON TERRITORY.

BY CHAS. H. STERNBERG.

Prof. Broadhead's interesting article on the Mastodon puts me in mind of some explorations I made in the Winter of 1877–78. While traveling on the Columbia river I met an army surgeon, who told me of mastodon bones being found on Pine creek, Washington Territory. I resolved to go there at once, and went to

Walla Walla to outfit, and with two assistants, went to Pine creek, where I met Mr. Copeland who had made large collections of remains of the Hairy Mammoth. He had felt a large skull in a spring on his farm, and with grappling irons hauled it to the surface. It proved a perfect specimen and excited his desire to obtain more. He therefore hired a number of men and proceeded to drain and dig out the spring. He first went through a bed of peat, then of clay and found a great many bones in a bed of gravel below, about twelve feet from the surface. He obtained a large collection of mammoth bones, as well as those of the bison and smaller animals. Mingled with the bones were pieces of charred wood. I discovered a spring near the head of Pine creek that promised well, as I could feel bones with a long pole. It was 100 yards from the creek and on about the same level. I first dug a ditch from the spring to the creek, which lowered the water about three feet. Then we dug down on the margin of the spring, through a bed of peat five feet in thickness, and through five feet of clay, hauling up the soft mud and water with buckets. Every night the hole we made during the day was filled with water and it had to be bailed out in the morning. At last we found the bed of gravel, with numerous bones lying on and through it. But, unfortunately, they did not belong to the mammoth, but to the North American bison, deer and other small animals of existing species. One interesting fact was, we found flint arrow heads and an instrument of bone mingled with the bones. This fact taken alone would only prove that man existed with the common bison. But taken in connection with Mr. Copeland's discoveries, it would prove that both man and the bison were contemporary with the mammoth, as man's implements associated with remains of the bison, were found under the same circumstances and vicinity with Mr. Copeland's specimens. Another proof of the great age of the bison is from the fact that its remains are found in various parts of Washington Territory and Oregon in beds of gravel, under twelve feet of lava. Hence, I suppose that if man, the mammoth and bison were contemporary, they were doubtless destroyed by an outflow of lava that covered most of eastern Washington Territory and Oregon.

ARCHÆOLOGY AND ANTHROPOLOGY.

ORIENTAL RESEMBLANCES IN NEW MEXICO.

BY C. N. HOLFORD.

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But there is to be seen here in New Mexico the impress of a civilization (the Arabic) older than that of Europe, older than that of Ancient Rome. And there are some grounds for believing that the ancient Pueblo civilization which the Spanish conquerors found here, and to a great extent displaced, is, if not the

direct offspring, at least the kindred of the civilization of the Egypt of four thousand years ago. The character of many of the ancient ruins from Zuni to Palenque and Copan, the type of heads and features sculptured thereon, the pottery of the Pueblos and Navajos—all, if not exactly resembling those of ancient Egypt, resemble nothing else in the world so much. The wooden plow used by the Indians of this Territory to-day is of the exact type found sculptured upon monuments that were old before the walls of Troy were built. The character of the country and climate considerably heightens these resemblances. Standing near one of these Indian pueblos and reading a page of Bayard Taylor's journey up the Nile, you might easily fancy as you looked around that the great traveler was describing the scene before you. The rude houses of sun-baked mud with occasional bits of vineyard about them; in the back-ground the barren flats or the low yellow sandhills; in front the broad river, its turbid waters changed to gleaming silver by the slanting rays of the blazing sun; and over all the pale, hot, quiet, cloudless sky. The dusky inhabitants in their scanty white cotton garments moving languidly about, the asses plodding afield or standing with mournfully drooping heads, and the rude, antique-looking implements seen here and there, harmonize well with the rest of this picture of ancient Egypt, as it were.

I have said that Spanish New Mexico bears tokens of the influence of the Arabian civilization, and it may not be clear at first sight how it can be so. It will be remembered that the immediate successors of the great Arab prophet carried their conquering arms and fanatic faith, not only to the walls of Vienna on the north, but along the whole southern coast of the Mediterranean, then swarmed up into Spain, crossed the Pyrenees and overran half of France. Though the mace of Charles Martel crushed their front at Poitiers and the swords of the Paladins scourged them back across the mountains, they held possession of more or less of Spain for nearly eight hundred years. Not only did this long dominion of so energetic a race deeply impress Spanish customs and architecture, and mingle, no doubt, much of its blood with the Spanish race, but when the last king of the Spanish Moors yielded the keys of his capital to the consort sovereigns of Aragon and Castile and bade adieu forever to the Alhambra's marble halls, many thousands of the Moors remained behind to still further impress their characteristics upon Spain. When they were finally expelled eighty years later by the foolish bigotry of Philip II Spain lost in them her most substantial citizens–her most skillful mechanics and enterprising traders. But, even thus, it is estimated that there are 60,000 *Morescos*, or persons of Moorish descent, in Spain. It is highly probable that so fine an opportunity for adventure as was opened by the discovery of the New World was embraced by thousands of an adventurous race whose ancestors carried their banners over two thousand leagues of conquest in Europe and Africa, and it is not unlikely that many of these *Morescos* were in the vanguard of the *Conquistadores*.

Santa Fe, except in its new American features, is a type of the remote, half-

Moorish towns of Estramadura three hundred years ago. The influence of the rest of Europe has greatly changed Spain since the days of Charles V, but that influence fell far short of New Mexico. In a few nooks of Spain a hundred years ago were remnants of these things which had already vanished from the more accessible localities. Cadalso, in his *Cartas Marruecas*, writing from one of these nooks, says: "The somber costumes, the women secluded in the houses or appearing on the streets only with faces muffled in black shawls, the houses with their blank street walls jealously hiding the inner courts * * * * * and many other things, have made me look into the almanac to see if it was really the year 1765, or the year 1500." Many of these things, to be seen only in the nooks of Spain a hundred years ago, can be seen in some New Mexican towns in the year 1880.

The ancient architecture of New Mexico is decidedly Moorish—though in the matter of public buildings, in the palmy days of the Moors in Spain, the Moors built of marble where the Mexicans have built of mud, yet in their less pretentious buildings adobe formed the principal building material of both people.

Lately I met a Frenchman who had spent twelve years in northern Africa and Arabia, and he said that for appearance of country, buildings, people, animals, climate, etc., the Rio Grande valley might seem to be a slice taken out of Algiers or Arabia—at least if the Gringo were taken out and the camel put in.

Had I space and access to books, to illustrate the resemblance of this country to orient lands I might quote from the writings of many observers, from the wonderful narrative of Moses, read by more than a hundred generations, to the pages of Bayard Taylor which, fresh from the writer's hand, charmed me when a boy. The soil, the sky, the animals, the implements, the pursuits and the manufactures—what a wonderful resemblance in those of the two regions. The rude Mexican cart with its ponderous wooden wheels and wicker boxes of cane or willow rods, drawn by oxen whose yoke is a straight stick lashed to their horns with rawhide thongs—just such carts are pictured in the most ancient bas-reliefs of the Orient—just such carts bore Jacob and his very numerous family from famine-stricken Canaan to meet his long-lost son, the viceroy of Egypt—just such carts bore the plunder of the Israelites on their long journey from the pastures of Goshen to the fords of Jordan—just such carts bore the baggage of Mohammed's lieutenants, toiling and creaking through three thousand miles of desert sands, from the Red Sea coast of Arabia to the Atlantic coast of Morocco.

The manner of threshing, cleaning and grinding grain, (and, it may be said, of growing and gathering it) in this region is the same as is described in the earliest records of the oriental nations. Moses wrote concerning "the ox that treadeth out the corn," and the ox is yet used, along with the ass and the goat, for treading out the grain of New Mexico. The Mexican threshing-floor is of the same description as that which David bought of Araunah the Jebusite, and the Mexican now winnows out his wheat in exactly the same manner as Boaz the Moabite was winnowing out barley the breezy evening that Ruth came a courting him. "Two

women shall be grinding at the mill," says the Hebrew prophecy, and it is said that in some parts of this territory to-day two women together grind wheat betwen flat stones—the one partly grinding it and the other completing the operation.

The "bottles" for wine mentioned in ancient records are known to have been goat-skin flasks, and such are in use to-day in this country; and so are the rawhide wine vats, such as were used by the wine makers of Syria ages ago, and perhaps even by the sons of Noah. Our native adobe-makers would probably find making "bricks without straw" as unsatisfactory as did the Hebrew slaves of the Egyptians thirty-four hundred years ago.

The ass and the goat, the "flocks and herds" of sheep, and the "cattle upon a thousand hills," are features upon almost every page of the literature of "the children of Shem dwelling in tents," from the day of Abraham to this day, as they would be in a literature descriptive of every-day life in the Mexican "plaza" or on the lonely ranch. In fact, the American tourist who is unable to visit Syria, Arabia, Egypt and Barbary, but who wishes to realize in the sight of living forms and actual landscapes what he has read of these "cradle lands," should come to New Mexico before the Gringo with his steam and electricity shall have swept away all these oriental resemblances except the landscape and the climate.—*Thirty-Four.*

ANCIENT WORKS IN NEW MEXICO.

New Mexico is perhaps the most noted country in the world for research. The historian, the wealth seeker and the "curious" can here find a rich field and reward for their labor. The Abo and Gran Quivira counties are perhaps the most renowned in the Territory for research. In the former there are evidences of great volcanic eruptions which overwhelmed cities and buried the inhabitants in ashes and lava long ages ago. It is evident that these people, who are perhaps older than the Aztecs, were a prosperous race, with not a little advance in civilization, as the Abo ruins in the Manzana Mountains indicate; also some indications of fine art; rude figures and the images of animals being found upon the interior of the walls of the structures beneath the debris.

It is evident that this non-historic race were seekers after mineral, and evidences also exist that mineral was obtained by them in paying quantities, there being the ruins of many old smelters and acres of slag found near Abo. Here mines are found with the timbers so rotten with age that great difficulty is experienced and danger incurred in going down into the old shafts, where shafts are formed.

One of our informants gave as his belief that either the flow of lava or falling leaves and dust had filled many of the shafts up, and the sand, earth and leaves so completely covered the ground that great care is required to find them, with but one or two exceptions—the Mount of the Holy Cross (so named) being about the only one that could be easily discovered.

XUM

One especially was found where human hands or lava or falling leaves and dust had filled it level with the earth, no shaft being discernible, and would not have been found, perhaps, had not an old trail been discovered. This was dug into and at a depth of twelve feet a man could, in places, thrust his arm in up to the elbow between the granite walls of the mine and the earth which filled the old shaft. The mineral, unlike our White Oaks country, does not seem to outcrop, but seems to be deep in the earth; no float having been found as yet except near the shafts or around the old smelters. On the eastern slope of the Manzana Mountains no quartz has been found excepting in a very burned and blackened condition. This part of the country will perhaps yield immense mineral wealth in time, and further developments and prospecting is awaited with great interest to many.

The walls of some of the old ruins at Abo are six feet of solid stone—lime and red sand—the walls in places are yet six feet in height and in a state of perfect preservation. In the ruins are found vessels of various designs and sizes made of pottery—some representing birds and animals. Stone hammers are found here, but no indications that sharp-edged tools were used in this ancient period. In digging down in one place the remains of an old aqueduct was found, which was probably used, as in the present day by the Mexicans for supplying the inhabitants with water.

It is thought and believed, by specimens of ore found, that gold, silver and copper were found in paying quantities. All the rock is more or less copper stained and some of it is so much so that some of the "country" rock has run as high as 37 per cent. copper.

Surely our bright, sunny land has been enjoyed long before the Anglo Saxon made his appearance upon the scene. The future of New Mexico can only be surmised. Every day new evidences of untold wealth are thrust upon us, and the day is not far distant when the multitudes of the East will flock to our borders and assist in the development of the greatest mineral region in the world.—*Era.*

CHEMISTRY.

CHEMISTRY IN 1727.

PROFESSOR T. BERRY SMITH, LOUISIANA COLLEGE, MO.

I have been reading a book—very large book—whose title page reads thus: "A New Method of Chemistry, written by the very learned H. Boerhaave, Professor of Chemistry, Botany and Medicine in the University of Leyden, etc., etc., translated by P. Shaw, M. D., and E. Chambers, Gent, London, MDXXVII CCXXVII."

I have found such curious ideas, statements, hypotheses, reasonings and conclusions in it, that I have deemed it would be interesting to the readers of the REVIEW to write down a few of them and have them again set in type. Of course, they will not now be printed with "f" for "s" and "em" for "them" and such other ancient modes for putting things; but, nevertheless, the words corrected and ideas will be interesting. I cull out only a few of the most strange statements, though the whole book is a curiosity.

I quote first the definition of Chemistry: "Chemistry is an art, whereby sensible bodies contained in vessels (or at least *capable* of being *contained* therein and *rendered* sensible;) are so changed by means of certain instruments, and especially fire, that their several powers and virtues are thereby discovered; with a view to the uses of Medicine, Natural Philosophy and other arts and occasions of life."

The author then proceeds to explain the various parts of the definition somewhat as follows:

It deals with *sensible* bodies. Bodies are sensible when they affect our senses; insensible when so *small* or so *remote* that they work no notable change on our organs of sense. Thus the air is full of an infinite number of heterogeneous corpuscles which have indeed an effect on our bodies, but it is such as our senses take no cognizance of.

They must be sensible bodies capable of being contained in vessels. The moon, though a sensible body, is no object of chemistry, for it is not capable of being contained in vessels. Gases are insensible aura or exhalations that would fly away unperceived; but being caught in alembics and retorts, come under the notice of our senses.

The "very learned" author then goes on to divide the world into three kingdoms much the same as we do at the present time; save that he uses the word "fossil" as we do "mineral." His definitions are these: *Fossils* grow adhering to the earth, and without distinction of parts. *Vegetables* grow adhering to the earth, and with distinction of parts. *Animals* grow without adhering to the earth at all.

He is very profuse in explanation. Passing on, we come to his divisions of the fossil kingdom; and the first is a metal. He says:

A metal is a simple fossil body that fuses and becomes fluid by fire; and by cold coagulates and hardens into a solid mass capable of distending under the hammer.

There are but six metals in all nature, viz.: Gold, lead, silver, copper, iron and tin. Some add mercury, but it does not agree with our definition in any respect. It is neither dissoluble by fire, malleable nor fixed. Yet the chemists hold that it is the basis of all metals, for by throwing in sulphur it becomes fixed into a metal. Hence as it is only a circumstance that is wanting to make quicksilver a metal, there is warrant for calling it by that name.

The symbols for the different elements used in those days were those which at present are used in our almanacs to represent the sun, moon and planets. It

seems the metals had received a kind of apotheosis or translation into heavenly bodies. The explanation is somewhat as follows:

Sol, the Sun—Gold.

Luna, the Moon—Silver.

Venus—Copper.

Mercury—Quicksilver.

Gold is a circle because it is perfection.

Silver. This figure would be a perfect circle if the inner part were properly applied to the outer. Now the chemists all agree that silver is half gold; but the gold lies hid. And they say if you could turn the gold part outward, your silver would be converted into gold, and the crescent signifies as much.

Copper is a circle with a cross underneath, *i. e.*, Gold with some corrosive menstruum.

The cross was the symbol of fire, aqua fortis, vinegar, etc. As the cross was to crucify or torture men, so these things serve, so to speak, to torture gold into other metals.

Mercury, the sign for quicksilver, shows gold in the middle, silver at the top, and a corrosive at the bottom; accordingly all the *adepts* say of Mercury, that it is gold at heart, whence its heaviness; silver on the outside, whence its whiteness; but there is a pernicious corrosive sulphur adhering to it denoted by the cross. So if it were perfectly calcined and purified, and its color changed, it would be gold. Take away the corrosive and the silver, and the gold will be left. Hence that maxim on mercury: Strip me of my clothes, and turn me inside out, and all the secrets of the world will come forth.

He then takes up the subject of specific gravity. He says: The character of the air influences specific gravity. There would be great difference between the pure fine air of London or Paris and the grosser air in most parts of Holland.

The specific gravity of metals is very great, the lightest of them being more than six times the weight of water. Hence this might be added to our definition of a metal: it is at least six times heavier than water. This fact is very useful in the business of mining. If in digging you find a glebe or mineral whose weight is six times as great as water, you may safely conclude there is a metal therein.

In a discussion of the properties of elementary bodies, his remarks are of the following nature:

It was a common saying of the ancient chemists that *the* SUN *and* SALT *contain all things.*

The truth is, sea salt is a thing of so beneficial a nature that we had better be without gold than salt.

Because gold is so little influenced by fire, some have argued that gold alone has its just proportion of fire, and is itself no other than fire perfectly concentrated. Gold is not sonorous. Hence the chemists hold that whoever would convert another metal into gold, must first take away the sound.

People who work in quicksilver mines all die in a little time. One man after six years was so full of it that, holding a piece of gold in his mouth a little while, it became of a silver color and heavier than before.

With reference to stones, he speaks thus:

Stones are popularly divided into two classes, vulgar and precious; or, which amounts to the same thing, opaque and transparent. The distinguishing mark of precious stones, as of metals, is the weight. Whatever stone has the weight of a diamond is really a diamond.

He explained what we call "fossils," in the following manner:

Stones grow like plants. When the seed of a stone gets into a shell of an animal, it grows and is molded into the shape of the shell; for example, cornua ammonis, our ammonite.

The stones most opposite hereto, as chalk and boles, are little else than earth ill bound together by a very small quantity of crystalline juice. If this crystalline juice found its way in quantity into the midst of any concretion and evaporated, the result was an agate or onyx.

Under the head of sulphur he speaks of Arsenic:

The second is arsenic, the most fatal of the whole tribe. It destroys all animals and man as the name indicates: *Aner*, man, and *nikao*, to conquer. In an ancient MS. ascribed to the Sibyls is a verse which plainly indicates Arsenic:

Tetrasyllabus sum; prima pars mei virum, secunda victoriam significat.

Coral was considered a plant. Thus I might multiply examples; but I have already gone too far. Such were the lessons taught by "very learned" men about one hundred and fifty years ago! And yet I have heard people declare that the world was not advancing in knowledge; that there "was nothing new under the sun;" and such like expressions.

In conclusion take this—an item from physiological chemistry:

The component parts of animals are spirit, water, salt, oil and earth. Spirit is an oily or sulphureous matter so subtilized as to be volatile by the smallest fire, and miscible with water. That there is such a spirit and a peculiar one, too, in every man, is evident from dogs. They track any one man or beast among a thousand; ergo some specific matter distinguishes the dog's master from the effluvia of all others.

Hippocrates would indeed presently pronounce the sentence of death upon any one sick of an unknown distemper wherein the secretions were obstructed and the skin appeared squalid, dry and parched. But a chemist would go deeper into the thing and show you that the aqueous and spirituous parts of the blood being here wanting, the salts which are now rendered more corrosive and sharp, are brought by the laws of circulation to the fine tender vessels of the cerebrum and cerebellum, which they either wound or tear, or else prevent the secretion of animal and vital spirits therein; whence death must necessarily ensue, which is saying something that satisfies the mind and rationally accounts for the thing.

XUM

PHYSICS.

THE ELECTRIC TIME BALL AT KANSAS CITY.

BY THE EDITOR.

More than a year ago some correspondence was had between Prof. C. W. Pritchett, of Morrison Observatory, George H. Nettleton, President of the Union Depot Company, of this city, and the editor of the *Review*, in regard to the establishment of an electric time ball at the Union Depot here, which resulted in an agreement by Mr. Nettleton to furnish the necessary funds to put it in operation at once. But for some reason not made known, the managers of the Chicago & Alton Railroad, over whose wires the signals were to have been sent, failed to join in the enterprise, and it was dropped temporarily.

Within the past month or two the matter has been taken up again, and principally through the efforts of Prof. H. S. Pritchett, Dr. E. R. Lewis and Mr. T. B. Bullene, the scheme has been successfully accomplished. The city council appropriated a portion of the necessary money, and the remainder was made up by private contribution. The time ball and accompanying apparatus were placed upon the new building of Messrs. Bullene and Sheidley, corner of Seventh and Delaware streets, the tallest and one of the finest structures in the city; and on January 5, at exact noon, the first signal was given. Since then it has been of daily occurrence. Connection has also been made with the city engine house, on Walnut street, where the fire alarm bell gives twelve taps simultaneously with the dropping of the ball; also with an electric clock at the jewelry store of Cady & Olmstead, and with the forty telegraphic stations in various parts of the city; so that absolutely true time is now the rule. As this is the fourth city in the United States where such signals have been adopted—the others being Washington, Boston and New York—our citizens feel quite elated, as well as indebted to Professor Pritchett for inaugurating an enterprise which is of great service to us and no little trouble to him, especially since he makes no charge for his services.

To give our readers a comprehensive idea of the working of the electrical apparatus, we append some extracts from a communication to the Kansas City *Times*, by Prof. H. S. Pritchett:

"The need of accurate time increases, of course, in proportion, as the business of a country becomes more intricate. The business of the country is so vast and complicated, and all the adjustments of life are to be made with so much greater nicety, that accurate time is a necessity for every city—and especially for every business city.

"Before accurate time signals can be distributed, however, to railroads or cities, it is necessary in the first place to have good instruments for the determination of time and good clocks. It may be of interest to our readers to know

something of the equipment of the observatory and the nature of the instruments upon which depends the accuracy of the time now being distributed each day to Kansas City.

"In the accurate determination of time there is necessary, in the first place, a good telescope, mounted firmly in the meridian, and known as a transit instrument. Fixed in the focus of this firmly mounted telescope are fine spider lines set perpendicular to the daily motion of the stars. The telescope being set upon a star, the daily revolution of our earth upon its own axis causes the stars to appear to move across the field of the instrument, and an observation of its transit across the threads of the transit instrument, after being corrected for the small instrumental errors, affords the most accurate means known for the determination of the clock errors, or, in other words, of the time. The standard clock itself is rarely changed, but its error is allowed to accumulate slowly from month to month. In sending the time, however, a different time-piece is used, which is compared with the standard clock just before the time of sending. In addition to the transit instrument and clock, most well equipped observatories of the present time are provided with a chronograph—an instrument for automatically registering by means of electricity both clock-beats and observations of star transits. The one in use in the Morrison Observatory was made by Alvan Clark & Sons, Cambridge, Mass., and the observations of transits are read off to the one hundredth part of a second, and time determinations are made to within that limit of error. The instrumental equipment used in Morrison Observatory time determinations is not surpassed by any observatory in America. The transit instrument itself is one of the largest and most firmly mounted. It is in most respects a duplicate of the instrument in use at the Royal Observatory at Greenwich, England, and was made by the same makers. Its cost in the shop in London was $4,500 in gold. The standard clock by Frodsham, London, and the chronograph, by Clark, cost in addition $1,000. These instruments—as good as can be made by modern scientific appliances—are capable of determining time as accurately as is possible in any observatory in the world, which may readily be distributed to any railroad or city in the west.

"The errors of the clock having been once determined, the distribution of correct time over the railroads and to telegraph offices is a very simple matter. In the method now pursued the local time is first changed into Kansas City time by applying the difference of longitude. At thirty seconds before 12 m., Kansas City time, each day, one of the break circuit clocks of the observatory is made to beat simply by turning a switch on the main line of the Western Union telegraph and the clock instantly commences to beat seconds in every telegraph office in Kansas City and along the line. At exactly 12 o'clock a double beat is given and the clock continues to beat till thirty seconds after, when it is shut off. The operators or any who may come to the offices to compare time-pieces, have thus three separate seconds which they can identify—the beginning second, which is thirty seconds before 12 o'clock; the double tick exactly at 12, and the last second

beat, which is thirty seconds after 12. So that any astronomer or any clock maker in any town into which these signals go may easily compare his clock with the standard clock of the observatory once each day by simply carrying a watch or chronometer to the telegraph offices, taking the precaution to compare his watch with his regulator before and after.

"These signals are amply sufficient for all connected with railroads or who can readily go to telegraph offices. In order to furnish time to a large city, however, it is necesssary to establish some signal which may reach the majority of business men in or near their places of business. There are but two methods in use which have been found to be practicable and efficient. One is the firing of a gun by electricity at some moment previously agreed upon. The Royal observatory at Greenwich fires several time guns in this manner—one very large one at Edinburgh, which can be heard for miles around. There are several objections to this method which readily suggest themselves. If nothing else, the expense of purchasing and the danger of firing a large piece of artillery would prevent the adoption of such a plan in most cities.

"The second plan and the one most generally adopted, consists in the instantaneous dropping by means of electricity of a ball attached to a staff placed in the most prominent point accessible. The Greenwich Observatory drops a ball at Liverpool at one o'clock each day—the ball being so placed as not only to give the time to the city but also to the shipping in the harbor.

"The ball dropped at Kansas City, and which signalizes the first attempt of this kind in western cities, is equipped in much the same manner as the one in use in New York, the apparatus used in dropping it being simpler and more easily managed, and not liable to get out of order. The ball is dropped in the following manner: At just five minutes before noon the ball is hoisted into position at the top of the staff. It is held in place by a rope attached to an arm and supported by an armature of a relay on a local circuit, which is closed in turn by the relay in the main office at Kansas City, which is in direct communication with the observatory. The closing of the main circuit at noon causes the ball to drop—sliding instantly down the staff—the instant when it leaves the top being exact noon.

"There is another matter in connection with these time signals to which the business men of Kansas City might well give some attention. The observatory clock-beats go out over the lines and into the various offices of Kansas City one each day, and might be sent more frequently if needed. This is Kansas City time, and is as accurate as all the appliances of modern astronomy can make it, and its preparation costs time and labor. We are anxious therefore that it should benefit as many people as possible. Now these signals which go into Kansas City might just as well go into every railroad office of every road running into the city, and thus at the same instant the same clock would beat Kansas City time in every village of every road centering at Kansas City—from Omaha to Galveston and from the Mississippi to Denver. The thought itself is one very flattering to the

enterprise of Kansas City, and its accomplishment would be of great material benefit to her. All that is necessary to accomplish this is to lead the different lines which already come into the same office into one relay, and it is accomplished at an expense of almost nothing. The wires could be so arranged that by simply turning on a switch two or three minutes before the signals are to come through, the clock-beats would go out on each line, and any interruption on one would not affect the others. The immense benefit to the railroads themselves, as well as to all business men generally, which would result from the adoption of such a system over the roads tributary to Kansas City, is almost incalculable—while all amateur astronomers who are in need of accurate time would be placed under lasting obligations. To bring about this result it is simply necessary for the managers of the roads centering in Kansas City to come to some agreement about the matter.

"At the last meeting of the American Association for the Advancement of Science held in Boston in August, the question of a uniform time system was brought up and a committee of astronomers was appointed to work up the subject for the ensuing year. Among the members of the committee were two of the astronomers of the Naval Observatory, the astronomers of the Cincinnati Observatory, Alleghany Observatory, Harvard Observatory, Morrison Observatory, New Haven Observatory, and others. Nothing definite was agreed upon, but one of the most favorable plans proposed by different persons was that which recommends the adoption of three meridians for the whole country, the time of the first meridian being from the Atlantic to the Mississippi, that of the second from the Mississippi to the Rocky Mountains, and of the third from the Rocky Mountains to the Pacific coast.

"Whatever plan may be finally adopted—and it is quite sure that with the constantly increasing railroad traffic some such general plan must be adopted in the course of time—there is no place better suited than Kansas City for distributing time to the whole of the Mississippi valley, and there seems to be no good reason why she should not inaugurate such a system as will make her permanently one of the great time centers of the country as she already has become one of its great business centers."

Since the adoption of the electric time ball signal at Kansas City, we observe that the people of St. Louis are moving in the same matter, and that at a recent meeting of citizens it was determined to raise $1,500 for the purpose.

XUM

MEDICINE AND HYGIENE.

MALARIA.

DR. W. B. SAWYER, KANSAS CITY, MO.

The term Malaria as applied by those outside the profession of medicine to disease is vague and often meaningless. It has been in certain localities quite the fashion to speak of many ailments of a more or less trifling nature as "malaria," and, with indifference to the appropriate use of terms, to call that a disease which is only a name for its cause. The primal and derivative signification of the word malaria is "bad air." Strictly speaking, however, all air vitiated by any substance poisonous in its action upon the body is bad air. The atmosphere of a closely packed audience room, loaded with carbonic acid, is clearly bad, while the stifling gases formed in the combustion of coal render the air of many family rooms anything but pure and good.

Malaria properly and in the signification given it by custom is an air poisoned by a definite something called miasm, the effects of which when taken into the body are manifested in a class of diseases of which "ague," or "chills and fever," is the type. Theories are numerous and discussion is endless as to the true nature of this miasm, but all theories and all discussions are based upon a few facts which the mass of human experience has shown to be incontrovertible. Leaving, then, to the medical profession to discuss the theories in detail as they are advanced, and to follow out minutely inquiries into the more scientific and difficult problems connected with the subject, there is still much to be learned in a broad and general way from the simple facts themselves.

In the first place this poisonous element exists in, and, under favoring conditions, emanates from the soil. At sea it is unknown or shows its presence only when a near approach to land brings it with the wind. Sleeping apartments on the ground floor are more often and more strongly contaminated than those above.

But though in and from the soil, it is only such soil as contains vegetable and perhaps mineral decomposing matter, and with the allied conditions of warmth and moisture. Marshy lands in warm climates are its most prolific sources, and in proportion as either one of the factors, water or heat, is diminished, so does its potency and virulence diminish.

The Pontine marshes and Jersey flats, in which latter locality an admixture of salt water seems to aid its generation, have always been covered with malaria, and similar tracts of moist country in warm latitudes are of like bad repute. Draining or flooding such a tract has an equally good effect in reducing miasm;

the former because one of the factors in its production is removed, and the latter because an excess of water either absorbs or prevents the dissemination of the poison. It follows also that high latitudes and high geographical elevations are less affected than the low, the other factor, of heat, being to a greater or less extent eliminated.

Stirring up soil that had previously been considered innocuous has in many cases, notably in parts of New York City, produced malaria from the exposure to sunlight and air of earth loaded with wet and effete matter; and, in the same way, withdrawing the water from lakes and ponds and its lowering in rivers give rise to similar results.

The noxious element gets into the atmosphere from direct contiguity, by wind currents, and by water courses in which it is carried, if not in solution at least in mechanical union, from one point to another.

Strictly speaking it is neither infectious nor contagious, and only produces its evil effects when taken into the body directly. It gains its access here chiefly through the respiratory process, though drinking water contaminated with it, or bathing in the same gives it some additional means of entrance.

When a person lives constantly in malaria or its neighborhood, especially if it be rich in miasm, disease is pretty sure to follow. Often, indeed, and perhaps usually, the trouble takes the form of some of the malarial diseases, so-called, whose chief characteristic symptom is a periodic disturbance of the heat-producing and regulating function. But it is a mistake to suppose that if this does not occur the system has become inured to miasm and tolerant of it. The whole constitution is more or less weakened and is rendered more easily a prey to every form of ailment; and when a sickness does come, if indeed it does not at once, no matter what its name or class, assume the malarial periodicity, it will give evidence by its greater virulence and obstinacy, of the evil influence that has gone before. Convalescence from even slight illnesses becomes slow and subject to relapses, and the appropriate remedies in such cases are found to be inefficient until fortified by the specific—and if any drug deserves the name, it does for malarial infection—quinine.

Woodlands are much more free from miasm than open country. This is doubtless due in a great measure to the drainage which the roots of large or thickly growing trees keep up, and possibly to the absorbing action of their foliage. The fall, too, the season when all verdure is dead or dying, and hence less actively engaged in its process of respiration, is the time when this poison is most prevalent. Doubtless also the mechanical action of foliage is a factor in the protective influence of trees, since a widespread shade must tend to hinder the formation of the evil principle and retard its diffusion. Night is more dangerous than day, since then the earth radiates the heat absorbed during the hours of light and with it sends forth its pestilential child.

Now, while no thinking person will undertake the care of his health without the advice of his medical man, when it is once clearly broken by this or any

other cause, every one may, by taking heed to a few simple matters suggested by the foregoing cursory review, greatly diminish his risks. If within his power he may select for his permanent abiding place a northern latitude, a high elevation, and a region of well timbered country. This done, though he is fairly out of the circle of ordinary malarial influence and is comparatively safe, his security is still not absolute, as some cause unforseen and not easily forecast may be in operation even in these conditions. But should circumstances compel a residence in a suspicious locality, even more care should be exercised. The house should be upon high, dry ground; the land about it turfed and not subject to be deeply or widely stirred; the drainage good, and if possible into running water. Trees of good size and abundant leafage should surround the house, and if it is desired to do all that theory has suggested the Eucalyptus globulus may be planted. It has been thought to possess certain specific properties against miasm, though its good effects must be due in great measure to its wonderful activity as an absorbent of water. The house should be built with special reference to free ventilation and its plumbing perfected in every way possible to prevent the entrance of foul air from the main sewer pipes without. The sleeping apartments ought to be upon the second floor, and neither thickly carpeted nor hung with heavy curtains. In selecting a water supply, cistern or surface water may be avoided if possible, a deep, clean well in high ground being best and safest.

But of more importance than these matters even, is the care to be exercised by the individual over the details of his own bodily health. All the rules of hygiene necessary everywhere for the promotion and continuation of good health are of paramount necessity where, in spite of all precautions, the body is forced to sustain the presence of a dangerous and unhealthy element. Every function —those of skin, lungs, muscles, nerves and bowels—should be watched and kept in the proper condition of action and reaction by careful scrutiny and the habitual application of the appropriate stimulant for each. To get away from malaria is the best way to cure it and prevent it, hence a trip to the north or into the mountains once or twice a year, if for a few days or weeks only, may prevent altogether an incipient malarial fever, or render less severe and of shorter duration the customary fall attack of "chills." The night air should be shunned, the morning bath of cold or chilly water never forgotten; outdoor exercise, to the point of exhilaration but never of exhaustion, daily obtained; a selection of nutritious, well cooked food, not highly seasoned but made savory and to relish, eaten; some form of coarse food taken also from time to time, and the native fruits, when ripe, in their season, and imported figs, oranges, grapes and prunes in the winter months. Add to these precautions plenty of sleep and a clear conscience and the risk of malaria is reduced to the minimum.

BOTANY.

HISTORY OF THE VEGETABLE KINGDOM.

REV. L. J. TEMPLIN, HUTCHINSON, KAS.

In tracing the history of the Vegetable Kingdom to its origin, we are carried back through a long series of fossil forms till we reach a point beyond which these forms cease to record the existence of vegetable organisms. But here it is evident we cannot stop. As in the history of human nations, we trace it back through authentic history till this will carry us no further; we then resort to tradition till it can guide us no further and we are left to grope our way in the darkness of conjecture and speculation. So in tracing the history of plants, we finally reach a point beyond which the stony record cannot guide us by the light of fossil foot-prints. But we are assured that we have not yet reached the beginning of these organic forms, and we are compelled to resort to other modes of inquiry to approach nearer to the source which at best we cannot hope ever fully to reach. The earliest records of plant history have probably utterly perished without leaving so much as a trace of their existence behind. The oldest fossil plants are found in Lower Silurian rocks, and these, with one or two doubtful exceptions, are all marine plants.

Below what has generally been regarded as the oldest fossil bearing rocks—the Silurian—is an extensive formation known as the Laurentian system. Until quite recently these rocks were considered azoic in character; but quite recently what is held by some as a fossil animal has been discovered in rocks of this formation in Canada, where they are enormously developed. Wide difference of opinion exists among scientific men as to whether this *Eozoon Canadense* is really of organic origin, and much discussion has been the result. But whatever may be the fate of this much disputed form, which was probably only one of many forms of protozoa that existed at that early period in the world's history, we have very strong reasons for believing that organic forms did exist in great abundance at the time these rocks were deposited. As the animal system is incapable of digesting or assimilating inorganic matter, it is wholly dependent on the organizing agency of the vegetable kingdom to organize the elements of earth, air, and water, into forms that will build up and repair the wastes of the animal system. From this consideration it is evident that plants must have preceded, or, at least, have been contemporary with the earliest animal existence. The existence of animals would, therefore, prove the parallel existence of plants, even in the absence of all other evidence of this fact.

If the animal nature of the *eozoon*, referred to above, be admitted, the existence of plants at the same time is established. But we have other proofs of the existence of plants during the period of the deposition of the Laurentian rocks. The first of these is the existence of extensive limestone deposits as form-

ing a part of the rocks of this formation. These limestones are in the form of marble, but all the rocks of the Laurentian system are highly metamorphic. These limestone beds are of great thickness and of vast geographical extent. Three bands of these, varying in thickness from 60 to 1500 feet, have been traced in Canada for more than 100 miles, and they are doubtless of much greater extent.

It is almost universally conceded that limestones, in all ages of the world, are of organic origin, having been built up from the stony forms of polyps and the shells of mollusks and crustaceans. That this is the manner in which the limestones of later ages have been built up does not admit of question, and we know of no good reason for assigning any other origin to those of this very early period. If, therefore, these extensive beds of limestone were produced by animal agency, it would necessarily demand the contemporaneous existence of enormous quantities of vegetation. Another fact that seems to demand a similar cause for its explanation is the existence of large quantities of carbonic acid in combination with the lime in these rocks. There is strong reason to believe that all carbonic acid originally existed in the air, as we find it still so existing to the extent of about .04 per cent. It is through vegetable agency that this gas is abstracted from the air and fixed in a solid form. It is held in this form till by the decay or combustion of the organic substance it is liberated again to enter into the atmosphere in a gaseous state. It was doubtless through vegetable agency that this substance was withdrawn from the air that it might be laid up in the stones. Admitting the correctness of this view, it would indicate a very abundant vegetation during the time these rocks were forming. That these limestones were of organic origin is further rendered probable by the fact that they are associated with hydrous silicates; especially serpentine and loganite, which may arise from the facility with which silica combines with bases in the presence of organic matters, or from the abundance of soluble silica in the hard parts of diatoms which probably formed the chief food of those animals that build their own skeletons of carbonate of lime. These facts create an almost irresistible presumption that the limestones of this period were of organic origin, which, if true, proves beyond question the prevalence of plants at, and probably long prior to, the time of their deposition.

A second indication of the existence of vegetation during the Laurentian period, is found in the existence of abundance of carbon besides that which exists in combination with lime in the limestones. This is found in the form of graphite or plumbago. This is simply one stage of coal, having probably existed in the form of ordinary coal at an earlier period of its existence. Coal exists in all degrees of carbonization, from the poorest quality of lignite to the pure substance in the form of graphite. The various stages of progress through which this process is carried on are indicated by lignite, bituminous and anthracite coals and graphite. The stage reached seems to depend on the extent of metamorphic agencies to which it has been exposed. In those regions, as in Northern Kansas,

where the heat and pressure have been very limited, we find an impure lignite; in those places, as the Western coal fields, where these agencies acted with greater but yet with moderate energy, the coal is bituminous; while in others, as in the Appalachian coal beds, where these metamorphic forces have operated with intense power, the coal is of that compact, highly carbonized character known as anthracite. But where the heat has been intense enough to fuse the rocks and the pressure so great as to force out all the lighter gases, leaving only the pure carbon, it becomes graphite. That this is the process by which graphite has been formed is evident from the fact that in the vicinity of fissures where the heat has been intense enough to metamorphose the rock, the bituminous coal has been changed into anthracite, and anthracite has passed into plumbago. Thus, at Worcester, Mass., a bed of graphite and pure anthracite occurs, interstratified with mica schist. It has been employed for both fuel and lead pencils. Thirty miles from this, in Rhode Island, an impure anthracite is found, containing impressions of leaves of coal plants. This is intermediate between the anthracite of Pennsylvania and the graphite of Worcester. From these facts it appears that graphite is only an extreme metamorphic condition of coal. When, therefore, we find large deposits of graphite in highly metamorphic rocks of the Laurentian period, the conclusion is irresistible that vast quantities of vegetation must have existed at the time they were laid down.

Still another evidence of the same fact is found in the existence of iron ore in these rocks. It appears that iron originally existed in a distributed condition in the clays and other rocks of the earth. Thus we find where iron ore deposits are found, the iron has been leached out of the adjacent rocks and they are destitute of any red color, while in red colored rocks, the iron still being distributed through them, no beds of ore appear. When the iron has been so taken from the rocks and gathered into deposits, it appears either in the form of ferric acid or carbonate of iron. We see this process in operation at the present day in the formation of bog iron ore. The manner in which this iron is collected is of much interest in connection with the question of the existence of vegetable matter in the adjacent rocks, for it will appear that such matter is an important agency in producing such deposits. The iron as it exists diffused through the rocks and soils is in the form of peroxide of iron, or ferric oxide, which is insoluble in water, and consequently cannot be washed out by percolating waters. Some deoxodizing agent is needed to bring about this result. This is found in decaying vegetable matter. Such decay is an oxidizing process, and when it takes place in the presence of peroxide of iron, the effect is to deoxidize it, reducing it to protoxide, by combining with a portion of the oxygen held in combination by the iron. Carbonic acid then combines with this protoxide, forming carbonate of iron, which, being soluble, is dissolved by percolating waters, which come to the surface as chalybeate springs. But when these chalybeate waters come to the surface, and are exposed to the atmosphere, the iron reabsorbs oxygen, and is converted back to peroxide, which is deposited at the bottom of any

basin where the waters may be retained for a time. But should there be an excess of decomposing vegetation present, as in peat bogs, this reoxidation cannot take place, and the metal is deposited in the form of carbonate of iron. The former of these methods is the more usual, though the latter is not infrequent. But the existence of iron ore in either of these forms proves the existence of vegetation at the time of its accumulation. Now, the Laurentian period was remarkable for the extensive beds of iron ore that were accumulated in its rocks. The vast deposits of iron found in the Iron Mountain regions of Missouri, the Lake Superior regions of New Jersey, and Sweden, all are found in the rocks of this period. Now, taking the above facts, either singly or in combination, they seem to establish beyond a doubt the existence, even during this time, of enormous quantities of vegetation, although not a vestige of it may exist in the form of fossils at the present time. The fact of the disappearance of all these organic forms may be easily accounted for in the extremely fragile character of all those primitive organisms. And while the above are only circumstantial evidences of their existence, they are of such a nature as to carry all the weight that belongs to ordinary direct evidence. We conclude, therefore, that the existence of limestones, graphite and iron, in the rocks of the Laurentian period, prove the existence of vegetation during the time of their formation, while the enormous extent of their existence is to be taken as the measure of its abundance. While we are thus positive of the existence, during the early period, of vast quantities of vegetable matter, in regard to the form in which it flourished we are left entirely to conjecture. But of one thing we are assured, and that is that no land plants existed at that day, for the very good reason that no dry land had yet appeared above the universal ocean that covered all the face of the whole earth, and consequently this class of vegetation could not have had any influence in bringing about the above results. All the vegetation of that age was doubtless of that simple yet extensive class of marine plants known as fucoids. The Archæan age, of which we have been treating, was followed by the Silurian; but, between the closing of the former and the beginning of the latter, there seems to have been a considerable lapse of time of which we have no record. As to the length of this unrecorded time, or as to what did or did not take place during its lapse, we are left wholly to conjecture, and the assumption that great changes had taken place in the organic development of higher from lower specific form, is a begging of the question, inconsistent with scientific methods of inquiry. With the incoming of the Silurian age, there was the sudden appearance of a wonderful variety of somewhat highly developed living organisms, especially of the animal series. The fossil remains of more than 10,000 different species of animals have been discovered in the rocks of this age, and others are almost constantly coming to light. Every class of the animal kingdom, except vertebrates, was numerously represented in the fauna of that age, while the individuals belonging to many of these species was above computation or even conception. Now some of these, as the Trilobites, that came in with the very beginning of

the age, were of highly specialized types. I do not say that these were not evolved from the low, protozoan types, that probably existed during eozoic times. I do not know how they were introduced. It may have been by evolution, but of this we have no evidence worthy of being called scientific. But, according to a principle already stated, we know the existence of such an extensive fauna demanded an enormous development of the vegetable kingdom to furnish, either directly or indirectly, sustenance for the numerous animals that thronged the Silurian seas. Unlike the previous age, we have in the rocks of the Silurian age numerous fossil vegetables, not only furnishing positive proof that they existed in that age, but also giving us an idea of their forms and structure. The plants of this age were, with very few exceptions, marine algæ. There are a few examples of land plants, the remains of which have been found in rocks belonging to this age. Recently two fossils from the lower Silurian in Ohio have been described as land plants of the genus Sigillaria; but the correctness of this conclusion has been called in question by very high authority, so that they are not to be permitted, for the present, to testify to the existence of such highly specialized plants at that early day. The only objection to giving these fossils their high position is their lack of decided characteristics to justify their claims to such honor. The remains of what are claimed to be land plants have been found in the rocks of this age in Sweden. All geologists claim that they are not algæ, and they are referred to as vascular cryptogams and monocotyledons. If this be their true character, we have here, even in the lower Cambrian, quite highly developed land plants. The trouble with all these specimens is, they are so void of distinguishing characteristics that we are liable to mistake a Thallogen for some of the more highly differentiated orders of plants. In Scotland there are traces of the remains of land plants in the lower Silurian; but their characteristics are not very positive, and, at best, they must have belonged to some humble class of endogenous plants. Undoubted land plants have been found in Canada, where, with a large number of fucoids, a few specimens of club-mosses have been discovered, that are referred to Prof. Dawson's genus *Psilophyton*.

In these both the fibrous bark and the scatariform axis remain and serve to guide to a proper classification. Such are all the evidences known of the existence of land plants during the Silurian age, and it must be confessed they are exceedingly meager, though in view of the fact that there was a large V shaped tract of land above the ocean between what are now the St. Lawrence river and Hudson's Bay, it is extremely probable that during the long time that intervened between the elevation of this land and the close of the Silurian age many land plants flourished, considerable numbers of which would be floated off and buried in the sediment of the Silurian seas. Much of this doubtless remains to be discovered. Next above the Silurian comes the Devonian Age in which, in addition to the humble plants noticed above, we find those of higher organization and more complex structure. These include all the orders of vascular cryptogams, viz: ferns, lycopods and equisetae. The Ferns were represented by a number of gen-

era, as Cyclopteris and Neuropterous; the Club-mosses by the Psilophyton introduced at an earlier time, and also by those giant vegetable organisms that prevailed to such an extent during the following age—the Sigillarids and Lepidodendrids; and the Equisetae by Calamites and Asterophyllites.

And here, in this early age, and certainly long before we should expect them according to the hypothesis of evolution, first appear true gymnospermous trees (*Conifers*), in the genus Protaxites. The true coniferous character of these trees is proved by the well known gymnospermous tissue and concentric rings of growth.

These were not simply shrubs, but trees of good size; some having been found eighteen inches, and others even as much as three feet in diameter.

It seems somewhat difficult to understand how, according to the doctrine of evolution, these highly differentiated organisms should appear at so early a period, and with so little preparation, in any of the forms that are known to have preceded them. These advanced forms would seem to indicate that if produced by evolution, it must have operated by "jumps" and not by "gradual modification," or as some have it, "That the steps of evolution were just at this point somewhat rapid."

While such assumptions are purely gratuitous, it is admitted they are absolutely essential to the existence of the theory. A large number of Devonian plants have been found; fifty or more species having been discovered in Nova Scotia alone. The sudden appearance of such a numerous and highly developed flora at the beginning of this age, is difficult to account for in harmony with the doctrine of evolution, except by the position assumed above of extraordinarily rapid advance at special times, or of a lapse of immense time between the close of the Silurian and the beginning of the Devonian ages. Either of these hypotheses might answer, but unfortunately neither has any foundation of proof on which to rest.

(*To be continued.*)

ASTRONOMY.

ANCIENT ECLIPSES.

WM. DAWSON, SPICELAND, IND.

EXTRACTS.

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Our most ancient record of an observed eclipse is found in Chinese history as having occurred in the reign of Emperor Chow-Kang. A little uncertainty still exists as to the exact time when this solar eclipse took place, but the most probable date is that of October 13, 2127 B. C.—about 4,007 years ago. On

Assyrian tablets in the British Museum, is found a record of a solar eclipse, total at Nineveh, June 15, 763 B. C. Uzziah, king of Judah, and the prophet Isaiah both flourished about this time It was also near this date that the shadow went back on the dial of Ahaz. One of the most interesting and important eclipses of ancient times is the one predicted with the saros by Thales, of Miletus. It occurred May 28, 585 B. C., and put an end to a long and bloody war between the Medes and Lydians. A battle was raging high near two hours before sundown of that eventful day, when the sun was suddenly darkened and day turned into gloomy night. This great change in the face of nature produced such an impression on the contending armies that they were both anxious to make peace, which was confirmed by a twofold marriage, in order to make it the more binding, "For without some strong bond there is little security to be found in men's covenants." The exact time and spot on the earth where this noted battle took place was for many ages a matter of doubt and contention among historians. But the accuracy of modern computations has settled the date (B. C. 585, May 28th, in the evening), and pointed out Asia Minor, near the northeast corner of the Mediterranean as the place.

About five and a half centuries before the Christian Era a king besieged the Median city of Larissa. The Medes held their own full well for sometime; but in 557 B. C., May 19, an eclipse of the sun so overpowered them that they gave way, and the Persians took the city without further trouble. A total eclipse of the moon, recorded by Pliny and Plutarch, occurred September 30, 331, B. C., eleven days before the celebrated battle of Arbela, in which Alexander gain ed a signal victory over Darius. There was a partial eclipse of the moon about two or three hours after midnight, March 13, 4 B. C.; and also a total lunar eclipse near midnight, January 9, 1 B. C. Now according to Josephus, the the death of Herod took place about the time of one of these eclipses, but which one does not seem very clear, as (it is said) he only speaks of one eclipse in all his writings. Herod died a short time, probably three months, after the birth of Jesus Christ. Hence it would seem uncertain whether our Savior was born about December 13, 5 B. C., or October 9, 2 B. C. It has long been supposed that his birth p ceded the Christian era by four years. Although there seems to be evidence in favor of the latter eclipse, making the birth of Christ early in October, 2 B. C., yet it may be safer to adopt the eclipse of March 13, 4 B. C., as the one to which Josephus alludes, and consequently the date December 13 (or probably 25) as being the time of birth of Christ. It has been claimed by some that an eclipse of the sun caused the darkness which attended the crucifixion of our Lord; but that event occurred at the time of full moon, and, of course, there could be no eclipse of the sun. Besides, the darkness continued many times longer than that of a solar eclipse.

An eclipse of the sun which was central and total some distance north of Jerusalem occurred November 24, 29 A. D. And on January 1, 47, a total eclipse was seen at Rome, and it is said in the same night an island rose up in the Ægean sea.

XUM

It being my purpose to give some account of a few of the most interesting eclipses among the many that have been seen and recorded in the past; I wish to mention a few in the earlier and middle ages of our own era. A total eclipse passed over Northern Italy in A. D. 237, April 12. "So great was the eclipse of the sun that people thought it was night, and nothing could be done without lights." During a total eclipse of the sun July 19, 418, not only stars became visible, but a great comet was discovered, which continued visible for four months afterwards. In 810, May 5, a total eclipse of the sun frightened Louis "the pious" emperor of the West. He died a little while after it, and seems never to have recovered the fright he received from the eclipse." A total solar eclipse came over London in the time of King Alfred, 878, October 29, at 1:16 P. M. It was not till 1715, after the long interval of 837 years, that another total eclipse of the sun occurred at London. An eclipse of the sun was observed at Cairo, December 13, 977; and another at the same place June 8, 978. A comparison of these two eclipses with the dates of some others seem to prove that the moon's orbital velocity is now a little faster than it was in ancient days. In other words, that it revolves around the earth in rather less time than it did in former ages. In 1033, 29th of June, a solar eclipse is described by a writer of the time as "exceedingly terrible, for the very sun became of a sapphire color." Computation indicates a great eclipse of the sun in England, August 2, 1133, which was considered a presage of misfortune to Henry I; and is thus alluded to by William of Malmesbury: "The elements manifested their sorrow at this great man's last departure, for the sun, on that day at the sixth hour, shrouded his glorious face, as the poets say, in hideous darkness, agitating the hearts of men by an eclipse." A great earthquake with horrid noise and a sinking of the ground is said to have happened about this time. But other accounts say that Henry died in 1135, December 1st. I look at both records (the eclipse and history) as high authority, and in this case feel quite unable to decide which is correct. On May 14, 1230, a total eclipse of the sun near sunrise seemed to prolong night into day. An eclipse of the sun was total in the south of France, January 1, 1386. A noted eclipse of the sun passed over Scotland June 17, 1433. The totality continued long at Edinburg about 3 in the afternoon. It was called the "black hour" for many ages afterward. In 1598, February 25, in the morning, was another total eclipse of the sun at Edinburg, and for generations following it went by the name of "Black Saturday." In 1560, August 21, a total eclipse of great duration occurred at Coimbra, Portugal, about which is said: "There was darkness greater than that of night; the stars shone very bright in the sky; women screamed and cried out that the last day of the world had arrived; and the birds fell down to the ground in fright at such startling darkness."

An account of the Columbus eclipse will be given in the words of another: "An eclipse of the moon which happened on March 1, 1504, proved of much service to Columbus. His fleet was in great straits owing to want of supplies, which the inhabitants of Jamaica refused to give. He accordingly threatened to

deprive them of the moon's light as a punishment. His threat was treated at first with indifference, but when the eclipse actually commenced, the natives, struck with terror, instantly commenced to collect provisions for the Spanish fleet, and thenceforward treated their visitors with profound respect" and plenty of food.

From a list of eighty solar eclipses already computed for England, I select a few which will be very large, and many of them total. In the early morning of August 3, 1887, a total eclipse in Germany and eastward. "The lovely orb of day having risen upon the summer scene, will appear to sink back into the arms of night, while the stars of heaven resume their twinkling." Another in 1900, May 28, 4 P. M.; 1905, August 30, 1 P. M.; 1912, April 17, at noon; 1927, June 29, 5 P. M.; 1951, February 15, 7 A. M.; 1999, August 11, near noon; 2026, August 12, 6 P. M.; 2081, September 3, 8 A. M.; 2093, July 23, noon; 2135, October 7, 8 A. M.; 2151, June 14, 6 P. M. In the twenty-third century a large total eclipse of the sun will occur every nine years, in the month of May, from 2227 to 2254.

In just 500 years from July 21, 1881, there will be a fine solar eclipse soon after 10 in the morning.

Whether or not the present economy of worlds be continued for thousands of years to come, "of this we may be certain, that as the phenomena we have described have excited men's marked attention from the earliest days, so they will continue to do till the end of time."

ASTRONOMICAL NOTES FOR FEBRUARY, 1881.

BY W. W. ALEXANDER, KANSAS CITY.

The Sun on the 1st will rise at 7 h. 10 m. a. m., pass the meridian at 00 h. 13 m. 55.24 s. p. m. and set at 5 h. 17 m. p. m., and on the 28th it will rise at 6 h. 38 m. a. m., and pass the meridian at 00 h. 13 m. 36.80 s. p. m. and set at 5 h. 47 m. p. m.

Mercury on the 1st will pass the meridian at 00 h. 36 m. p. m, and set at 5 h. 39 m. p. m. On the 28th it will pass the meridian at 1 h. 6 m. p. m., and set at 7 h. 09 m. p. m. The 22nd presents a very favorable time to see this planet, it being 18° 08′ east of the Sun.

Venus on the 1st will pass the meridian at 3 h. 07 m. p. m., and set at 9 h. 07 m. p. m. Its apparent size and brilliancy are fast increasing. During this month it may be seen by a good eye in daylight, if the atmosphere is clear. About 3 h. p. m. it is in the south and in the best position to be seen. On the 22nd it is in conjunction with Jupiter, being 3° 20′ north of that planet.

Mars on the 1st will rise at 5 h. 33 m. a. m., and will pass the meridian at 10 h. 11 m. a. m., and on the 28th it will rise at 5 h. 00 m. a. m., and will pass the meridian at 9 h. 51 m. It is quite small and difficult to find.

XUM

Jupiter on the 1st will pass the meridian at 4 h. 08 m. p. m., and set at 10 h. 24 m. p. m., and on the 28th it will pass the meridian at 2 h. 41 m. p. m., and set at 9 h. 04 m. p. m. On the 22nd it will be in conjunction with Venus, passing south of that planet 3° 20′.

Saturn on the 1st will pass the meridian at 4 h. 41 m. p. m., and sets at 11 h. 04 m. p. m., and on the 28th it will pass the meridian at 3 h. 04 m. p. m., and will set at 9 h. 30 m. p. m.

Uranus on the 1st will pass the meridian at 2 h. 11 m. p. m., and on the 28th at 0 h 21 m. a. m.

Neptune on the 1st will pass the meridian at 5 h. 49 m. p. m., and on the 28th at 4 h. 4 m. p. m.

The Moon on the 2nd is in conjunction with Venus, passing north of that planet 5° 28′. On the 3rd it will pass Saturn and Jupiter. On the 5th it will pass Neptune and will be in conjunction with Uranus on the 15th. It will also pass Mars on the 25th.

METEOROLOGY.

CLOUDS.

PROF. BY S. A. MAXWELL.

In this article I propose to say a few words concerning *popular errors* in reference to clouds and storms. The first of these which I shall notice is the so-called *return of a storm*, after it has passed. Some people tell us that a storm frequently makes a retrograde movement, *i. e.* having passed in an easterly direction, it stops, changes its course, and returns toward the west. Now I do not wish to dispute any one, for I do not know what persons may have seen in other lands, but, so far as our locality is concerned, this particular phenomenon has never occurred during the last fifteen years. I know that many times there appears to be such a motion; but such motion is apparent, not real. After a shower has passed there is very often a large area in the track of the storm, over which are floating clouds which are just ready to discharge their vapors in the form of rain. These clouds suddenly begin to precipitate rain, and the casual observer would remark that the storm was returning from the east. Let those who harbor the idea that a storm ever retraces its course, please to observe in which direction the clearing up commences and the sky first appears; in all cases it will prove to be very nearly in the same direction as the storm came up. The deception is often rendered still more complete by the direction of the wind; and this leads us to the consideration of the *second error*, which we shall notice, viz.: that the *direction of the wind at the earth's surface is not the same as in the higher regions of the air*, where the storm clouds float. It is a very common belief that the snow storms, called Northeasters, come from the northeast; but it

is the surface wind only which comes from that direction; the storm-clouds themselves always moving from the west or southwest. This fact has been known to scientific observers ever since the researches of Benjamin Franklin established it as a fact. A storm of this character which rages one day in Missouri or Iowa will, on the next, be found in the regions of Lake Erie. Numerous cases like this have been noted in the *Weather Review*; and what is perhaps the main point to be observed is, that no record has yet been made of any great storm moving in the contrary direction *i. e.*, from the east or northeast.

Another error which deserves notice all the more, since meteorologists of some repute hold to it, in common with the general public, is, that tornadoes which occur on the same date are identical; for instance, it is maintained that the Marsh, field tornado and the one in Southern Illinois on the same date, were one and the same. Now, though these occurred less than four hours apart in point of time, it is hardly probable that they were identical, since the localities where they occurred are so widely separated that a storm could not possibly have passed from one to the other in so short a space of time; and further, since another storm happened the same afternoon in Kentucky, and still another in Northern Illinois, it looks more as if there were certain physical conditions operating, which made tornadoes possible; and, indeed, this was the case throughout a large portion of the Mississippi basin. These conditions were in brief:

1st. Low barometric pressure.

2nd. High temperature.

3rd. Strong southerly winds.

4th. Probably, favorable electrical conditions.

These are the combinations of circumstances which produce tornadoes, and are seen to co-exist on days when these storms are numerous; as on May 6, 1875, when there were tornadoes in Kansas, Missouri and Illinois, or the date of the Mineral Point storm, on which day numerous similar storms were reported from different localities.

These facts seem to prove that tornadoes are the result of certain atmospheric conditions, and that they are not necessarily identical, even though they occur on the same date, and at places not very distant from one another.

MORRISON, Ill., Jan. 8, 1881.

THE WEATHER PROPHECIES (?) OF VENNOR.

ISAAC P. NOYES, WASHINGTON, D. C.

A person who makes himself so conspicuous before the world as Mr. Vennor has done during the past year by his attempted prophecies of the weather, must expect to invite criticism; especially so when his pretensions are so at variance with science and common sense.

In the absence of facts it is not surprising that there is great ignorance—be the subject what it may. Only within a few years have sufficient facts been

obtained to enlighten us in regard to the weather. These facts have all been gathered and put into shape by our complete Weather Bureau, and are daily spread before us on the Weather map. He who will learn to read and understand this simple yet wonderful contribution to the scientific knowledge of the world will see more and more beauty and wonder in the works of nature than was ever dreamed of in the days of the old Farmer's Almanac. With all this we have a man now attempting to revive and compete with the old Farmers' Almanac—endeavoring to make the people believe that it is something wonderful to guess what the weather will be months in advance. If this man would only come out boldly and proclaim that his efforts are all guess work, founded upon the weather of previous years, and say that from facts recorded there is a possibility of the weather repeating itself occasionally, and therefore we may possibly, at a certain time, have a certain kind of weather, all well and good. But the weather does not repeat itself wholly. There is a similarity at times, but nothing regular enough to warrant any fixed statement that can be depended upon.

The storms which have occurred in the United States the last half of this month, December, 1880, well illustrate and may well be taken as a good example of the dependence that may be placed on the weather prophecies (?) of Mr. Vennor.

If the public were better informed as to the laws governing the weather of the globe, instead of creating a surprise that so many have faith in such statements and claims, the surprise would be that any man of scientific knowledge would have the least respect for them, at least unless Mr. Vennor world distinctly put them on the basis of mere guess-work and let them be understood to be such. It is no new thing, nor anything patented to Mr. Vennor, that there is a similarity between the weather of the months of the different years; but though there may be this similarity in the weather, it never wholly repeats itself. Yet, with all this, people wonder, and even demand, why the U. S. Weather Bureau does not compete with this man. If people will only study the Weather map sufficiently to understand the laws that govern the weather, they will readily tell why. But this they will not do, but, instead, prefer to remain in ignorance, and then foolishly demand of the Weather Bureau a physical impossibility. The Weather Bureau could *guess* at the weather for ten or even a hundred years ahead; but suppose they should attempt it, would these people be one-tenth as charitable toward it, as a government institution, as they are now toward a private individual? One can safely say that they would not be. Then no sensible man, with full knowledge of the laws of meteorology, would want to attempt such a thing, for he well knows that there is no certainty in the weather of different years repeating itself. There may be a similarity, but that is all.

Mr. Vennor pretends to forecast the weather. His pretensions consist in statements as to great storms and very general comments as to what will be. Does it not strike sensible men as absurd that a man should only be able to foretell great snow storms and great commotions generally, and not specifically?

Would it not seem that if he *knew* anything about the weather, he would not only be able to tell for every day in the year, but for every locality—say for every square of fifty or a hundred miles—and able to tell it every time. What would the public think of a doctor who was only able to treat a few of the most difficult complaints and quite ignorant of the human system and the great majority of the ordinary diseases which afflict the human race? Able to treat severe cases one day and unable to treat them the next? It would seem that if a doctor was able to treat phthisis and typhoid fever, he would know a little about measles and be able to treat patients for boils and colds. It would seem queer if a person regarded as a scholar knew only a few "big words" and was quite ignorant of the ordinary words used in every day life, and only knew these "big words" at times. What would we think of a person who pretended to be a teacher of geography and could only impart information in regard to a few of the largest rivers and mountains of the world, and knew nothing about the geography of every-day life?—would not know in which direction to travel to reach Chicago, St. Louis or New York? It is impossible to imagine such a teacher holding any rank in society or commanding any influence among his fellow men.

What would the captains of the ocean steamers think of a man who pretended to tell them what kind of weather they would have every voyage? To be sure, a person might make a study of voyages and the months of the year and venture a guess, but even then he would be no wiser than the captains and their crews. No captain would be foolish enough to put faith in such forecasting of his voyage, for he knows very well that, though the voyages of the same seasons may resemble each other, they are not wholly alike. But if he could have daily communications from all about him while on the voyage, and from day to day, or at times, receive information for three or four days in advance, he would have something that would be of advantage to him. But this, at least at present, is impossible to have on the sea, but its equivalent we do have on the land. We have stations all over the country. The information is collected at a central point and then distributed over the whole country for the benefit of all. This information can only be gathered from day to day—it cannot be gathered in advance; still oftentimes we have the weather for three or four days ahead quite well defined or indicated. This does not always happen and cannot be depended upon, neither can dependence be placed in the idea that it will repeat itself; for it never wholly does so. It may in part, but if we cannot have it complete, what use is there in a mere similarity in parts? The dissimilarity of other parts will change the face of the whole. This fact is evident every day. We often times have a weather map similar for different days, but the dissimilarity makes quite another thing of the weather of the United States as a whole.

Because it was reported that Mr. Vennor "prophesied" that we were to have an immense snow storm generally over the United States on the 22d of December, the storms that have passed over the country from the 16th to the end of December are credited to him. The storm of the 17th was telegraphed over the

country from Chicago, "Vennor's storm coming," and people who do not know any better think that all the storms that have passed over the United States since the 16th inst. are only parts of "his storm." On the 16th of December *Low*, or the storm center, was in the Indian Territory and Texas. On the 17th it moved over Missouri and Arkansas, and on the 18th passed off the North Carolina coast. The results of this storm were very light snows north of the Ohio river, Iowa to Ohio, and to the south light rains, and very light snow on the 18th in the North United States and Canada.

On the 19th a new *low* in the Southwest: It followed a usual course and yet not a fixed course. As it advanced it took nearly a northeast direction, and passed off the coast on the 21st with the center about on a line with the mouth of the Chesapeake Bay. This, of course, caused an area of snow-fall within a circular line, taking in the southern part of Connecticut, sweeping around to Maryland and Virginia. It was not general throughout the United States. It was not what might be termed a very heavy fall of snow—nine inches on a level is all that can be claimed for it at Washington, and hardly that.

To all fair-minded persons it would seem that a fair interpretation of the "prophecies" would have been to have had even a heavy fall of snow generally over the northern portion of the United States and Canada. Instead, the area of this storm was very limited, being confined to a very small section of the United States along the Atlantic coast, and was all over before the day claimed for it, and a new one on the way. On the 24th a new *low*, or storm center, developed in Central Southern Mississippi. On the 25th it moved to the North Carolina coast and thence up along the Atlantic coast toward Boston, where, on the 27th, about nine inches of snow fell; thence this area of *low* passed off the coast and toward Nova Scotia. It will be seen that the track of this storm was similar to the one that preceded it and produced similar results, yet not extending into the interior as far even as the other; merely touching the coast—yet a good example of how one storm may resemble another and still not produce the same results.

On the 28th still another *low* passed over the Gulf, and on the 29th disappeared, northeast into the Atlantic, giving rain on the immediate South Atlantic and Gulf coasts, and snow in the interior, and light snows thence to the Ohio Valley and New Jersey. With all these snow storms very little fell generally throughout the United States. Most of the snow fell in and about the immediate Atlantic coast from Boston to Washington, while in Maine, and even in the eastern parts of Canada, it has been relatively warm, with rain; at Providence, R. I., very little snow, none to speak of at Albany, and very little throughout the West. While these snow storms were mostly concentrated, as here stated, along the Atlantic coasts, the temperature was warm in upper New England territory and Eastern Canada, while it was severely cold all to the west of these storm centers, generally over the United States and Western Canada, and even at times to the extreme South.

The simple reason of this was that, as heretofore stated in these papers, the wind is always toward the center of the area of low barometer. As all of these *lows*, excepting that of the 16th to the 18th, traveled on a low line of latitude, the wind was generally from the north—that is, from the north at first and then from the west and northwest. This continuing for so many days created an intense cold throughout the greater portion of the United States and Canada, the *northeast corner* being the only warm section of the country for the time being.

As to the hitting of dates when a storm will pass over the country, when it is known that an area of low barometer generally passes over the United States from every three to four days, it is not at all surprising that one may venture a guess and get within a day or two of when a storm will pass over some portion of our vast territory. Then this is the season of snow storms for the Northern Hemisphere. Because we have had these snow storms, thoughtless people in the neighborhood where these storms have occurred give all the credit to Mr. Vennor. Suppose these same people lived in Maine, New York State, or anywhere in the West, north of the Ohio Valley, where they might have expected snow and had none to speak of, what would they think of prophecies which were not fulfilled any better for their vast districts? Nothing can be more absurd than these attempts at forecasting the weather. There is nothing certain, scientific, or reliable about it.

If Mr. Vennor will go back to the "first principles" and tell us where the storm center will be months in advance, then we will think that he has some superior knowledge; but until he can do this he had better not venture any more guesses in regard to the effects which follow these first principles.

WASHINGTON, D. C., Dec. 31, 1880.

METEOROLOGICAL SUMMARY FOR THE YEAR 1880.

FROM OBSERVATIONS TAKEN AT LAWRENCE, KANSAS, BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS.

The year 1880 surpassed all previous years of our record in the warmth of its January, the coldness of its November, its maximum monthly and hourly velocity of wind, and the earliness of its spring and winter. Maples were in blossom February 11th, and genuine winter weather began November 11th, continuing without interruption to the end of the year.

The temperature, wind velocity and relative humidity were *above*, while the the fall of rain and snow and the cloudiness were *below* the annual averages.

The most remarkable meteorological event of the year was the wind storm of March 27th, which filled the air to a great height with an almost impalpable dust, and obscured the sun during the entire day after 10 A. M.

Mean temperature of the year, 54.01 deg., which is 0.72 deg. above the mean of the twelve preceding years. The highest temperature was 101 deg., on August 18th; the lowest was 12 deg. below zero, on the 29th of December,

giving a yearly range of 113 deg. Mean at 7 A. M., 48.10 deg.; at 2 P. M., 63.55 deg.; at 9 P. M., 52.20 degrees.

Mean temperature of the winter months, 34.88 deg., which is 5.17 deg. above the average winter temperature; of the spring, 56.63 deg., which is 0.33 below the average; of the summer, 74.92 deg., which is 1.60 deg. below the average; of the autumn, 49.56 deg., which is 3.58 deg. below the average.

The coldest month of the year was December, with mean temperature, 25.84 deg.; the coldest week was December 25th to 31st, with mean temperature, 9.41 deg.; the coldest day was December 28th, with mean temperature 2.7 degrees below zero. The mercury fell below zero only twice during the year, on December 28th and 29th.

The warmest month was July, with mean temperature 75.75 deg.; the warmest week was August 13th to 19th, with mean temperature 82.61 deg.; the warmest day was August 18th, with mean temperature 86 deg. The mercury reached or exceeded 90 deg. on 41 days, viz.: 1 in April; 7 in May; 8 in June; 13 in July; and 12 in August.

The last light frost of spring was on April 30th; the first light frost of autumn was on September 13th, giving an interval of 136 days (nearly 5 months), entirely without frost. The last severe frost of spring was on March 20th; the first severe frost of autumn was on October 17th, giving an interval of 211 days (nearly 7 months), without severe frost. No frost or cold weather during the year did any damage to fruit buds or trees. Both large and small fruits were produced abundantly.

The entire amount of rain, including melted snow, was 32.65 inches, which is 3.34 inches below the average annual amount for the twelve preceding years. Either rain or snow fell on 89 days—12 less than the average. On 11 of these days the quantity was too small for measurement. The longest interval without rain during the growing season (March 1st to October 1st) was 18 days—from August 2d to 19th. The number of thunder showers was 29. There were 4 light hail storms, all of which occurred in March, April and May.

The entire depth of snow was 7 inches, which is about one-third of the average. Of this amount 3 inches fell in March, 2½ inches in November, and 1½ inches in December. The last snow of spring was on March 15th; the first snow of autumn was on November 16th.

The average cloudiness of the year was 40.15 per cent., which is 4.18 per cent. below the average. The number of clear days (less than one-third cloudy) was 196; half clear days (from one-third to two-thirds cloudy), 87; cloudy (more than two-thirds), 83. There were 65 days on which the cloudiness averaged .8 or more. There were 51 entirely clear and 33 entirely cloudy days. The clearest month was February, with an average cloudiness of 24.94 per cent. The cloudiest month was December, with an average of 54.08 per cent. The mean cloudiness at 7 A. M. was 44.79 per cent.; at 2 P. M., 44.20 per cent.; at 9 P. M., 31.48 per cent.

During the year, three observations daily, the wind was from the sw. 324 times; nw., 242 times; se., 158 times; s., 113 times; ne., 107 times; e., 61 times; n., 55 times; w., 37 times; calm, *once*. The south winds (including southwest, south and southeast) outnumbered the north winds (including northwest, north and northeast), in the ratio of 595 to 404.

The number of miles traveled by the wind during the year was 146,039, which is 9,154 miles above the annual average for the 7 preceding years. This gives a mean daily velocity of 389.01 miles, and a mean hourly velocity of 16.62 miles. The highest velocity was at the rate of 80 miles an hour, from 3:30 to 3:45 A. M., on April 25th. The highest daily velocity was 1,121 miles, on March 27th and April 18th; the highest monthly velocity was 16,709 miles, in April. The three windiest months were March, April and May; the three calmest months were July, August and September. The average hourly velocity at 7 A. M. was 15.30 miles; at 2 P. M., 18.44 miles; at 9 P. M., 15.70 miles.

Mean height of barometer column, 29.123 inches; at 7 A. M., 29.148 in.; at 2 P. M., 29.099 in.; at 9 P. M., 29.123 in.; maximum, 29.791 in., on November 21st; minimum, 28.303 in., on April 18th; yearly range, 1.488 inches. The highest monthly mean was 29.295 in., in November; the lowest was 29.019 in., in May. The barometer observations are corrected for temperature and instrumental error.

The average atmospheric humidity for the year was 67.9; at 7 A. M., 79.2; at 2 P. M., 49.9; at 9 P. M., 74.6. The dampest month was December—mean humidity, 76.5; the dryest month was April—mean humidity, 53.4. There were 18 fogs, of which 9 were in January and 4 in December. The lowest humidity for any single observation was 11.8, at 2 P. M. on April 14th—less than one-eighth of saturation.

The following tables give the mean temperature, the extremes of temperature, the velocity of the wind, the per cent. of cloudiness, the relative humidity, the rainfall (including melted snow), and the depth of snow for each month of the year 1880, and a comparison with the 12 preceding years:

1880.	Mean Temp'ture.	Maximum Temp'ture.	Minimum Temp'ture.	Miles of Wind.	Mean Cloudiness.	Relative Humidity.	Rain inches.	Snow inches.
January....	41.23	67.0	20.5	12,861	48.49	73.8	1.80	0.0
February..	37.58	69.0	8.0	11,861	24.94	64.5	0.73	0.0
March.....	42.38	79.0	2.5	13,841	44.94	63.4	2.03	3.0
April.....	56.92	93.0	31.0	16,709	34.56	53.4	1.75	0.0
May.....	70.59	94.0	52.0	14,108	40.43	62.6	4.11	0.0
June.....	73.57	96.0	50.5	12,629	37.00	68.1	4.10	0.0
July..	75.75	98.0	54.0	9,312	28.23	68.3	2.34	0.0
August....	75.45	101.0	50.5	8,863	45.70	70.8	7.93	0.0
September.	64.59	85.0	42.0	10,124	32.00	73.2	2.46	0.0
October....	52.52	81.0	28.0	12,745	39.24	66.3	2.73	0.0
November.	31.58	65.5	7.5	11,325	51.77	74.4	2.24	2.5
December.	25.84	61.0	−12.0	11,661	54.08	76.6	0.43	1 5
Means.....	54.01	82.5	27.9	12,169	40.15	67.9	2.72	0.6

COMPARISON WITH PREVIOUS YEARS:

YEAR.	Mean Temp'ture.	Maximum Temp'ture.	Minimum Temp'ture.	Miles of Wind.	Mean Cloudiness.	Relative Humidity	Rain inches.	Snow inches.	Rainy days.
1868	53.36	101.0	*–16.5	.....	42.35	.....	37.42	27.50	77
1869	50.99	96.0	– 5.0	.....	49 23	.....	38.51	18.00	105
1870	54.50	102.0	–10.0	.....	47.88	68.4	31.38	9.50	100
1871	54.30	103.0	– 6.0	.....	47.37	.....	33.23	29.75	120
1872	51.90	97.0	–18.0	.....	44.33	64.4	32.63	23 25	116
1873	52.71	104.0	–26.0	154,508	42.46	64.0	32.94	26.50	101
1874	54.20	108.0	– 3.0	145,865	45.54	65.5	28.87	43.00	99
1875	50.60	99.0	–16.5	145,316	44.81	65.5	28.87	5.00	106
1876	52.76	98.0	– 5.0	148,120	41.27	66.8	44.18	24.75	102
1877	54.16	99.0	– 9.0	113,967	47.12	72.6	41.09	15.50	126
1878	55.33	98.0	– 6.0	125,793	40.65	70.4	38.39	25.50	107
1879	54.67	99.5	–16.0	124,768	40.01	67.1	32.68	10.35	90
1880	54.01	101.0	–12.0	146,039	40.15	67.9	32.65	7.00	89
Mean 13 yrs	53.34	100.4	–13.0	138,047	41.09	67.2	34.83	20.43	103

METEOROLOGICAL OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KANSAS.

PROF. J. T. LOVEWELL.

Our last report closed December 20th. From the 27th to end of month the weather was very cold, the mean daily temperature on the 27th, 28th and 29th being respectively, -3.3°, -6.2° and -3.2°. The minimum thermometer on the 29th recorded 21½ degrees below zero. This cold period has extended into January and the temperature has fallen below zero on five days—the 3rd, 9th, 10th, 13th and 14th. On the 9th it was 15° below zero. The last decade has been somewhat warmer than the two previous, as will be seen by the tables below. There has been but little snow, not enough for sleighing any time, but on more than half the days embraced in this report the cloudiness has averaged eight-tenths and more. Lunar halos and parhelia have been frequent. The prevalence of north winds has been noticeable, nearly two-thirds of the observations being north and north-west. The air has been moist and the evaporation therefore light, which lessens the danger to crops from the continued absence of rain. The barometric pressure has been high as is usual here when north winds prevail, and the fluctuations of pressure have been less than usual.

*The Minus sign denotes temperature below zero.

RECORDS DEDUCED FROM AVERAGES OF DAILY OBSERVATIONS.

	Dec. 20th to Jan. 1st.	Jan. 1st to 10th.	Jan. 10th to 20th.	Mean.
TEMPERATURE.				
Min.	3.6	0.8	9.4	4.6
Max.	19.7	24.5	30.8	25.0
Mean of Max and Min.	11.6	12.7	20.4	14.9
Range.	15.1	23.7	21.4	20.1
7 a. m.	6.6	4.8	14.5	8.6
2 p. m.	17.3	13.7	23.9	20.0
9 p. m.	11.1	11.9	19.0	14.0
Mean	11.5	11.8	19.1	14.1
REL. HUMIDITY.				
7 a. m.	0.77	.....	.....	.....
2 p. m.	0.74	.....	.....	.....
9 p. m.	0.77	.....	.....	.....
Mean	0.76	.....	.....	.....
PRESSURE, sea-level, 32° F.				
7 a. m.	30.4	30.2	30.1	30.2
2 p. m.	30.3	30.2	30.1	30.2
9 p. m.	30.3	30.2	30.1	30.2
Mean	30.3	30.2	30.1	30.2
WIND.				
Miles Traveled	3,014	2,824	3,490	9,328
RAINFALL.				
Inches	0.03	0.01	0.06	1.00

SOLAR HALOS.

BY PROF. S. A. MAXWELL.

On the 29th of last month, at eight o'clock in the morning, a most beautiful solar halo was observed from this locality. The mercury at the time indicated —12°, and the air was filled with particles of frost. The halo consisted of: First, a circle, 45 degrees in diameter, of white light, the sun being in the center; second, another circle of white light, parallel with the horizon, at the same altitude as the sun, and at right angles to the first circle; third, an iridescent arc of perhaps 90 degrees, belonging to a circle of 45 degrees diameter, and having the zenith for its center; fourth, a vertical column of white light, with the sun for its base.

The points of intersection of the first and second circles were adorned with two splendid parhelia of prismatic colors. The colors in the arc near the zenith were arranged as in the primary rainbow, the red being on the outer, or convex side.

A similar halo occurred on the morning of March 16th, 1870, when the temperature was 12° above zero; though, in this case the zenith circle was complete, but not prismatic, and the second circle was adorned at the cardinal points by mock-suns of surpassing brilliancy.

MORRISON, Ill., Jan. 10th, 1881.

PARHELION IN KANSAS CITY.

BY WM. H. R. LYKINS.

A phenomenon of rare occurrence in this latitude was observed in this city on the morning of the 7th of January. Just before sunrise a well defined image of the sun, apparently about fifteen minutes high, appeared shining at the intersection of two broad bands of light crossing each other at right angles. As the sun rose the image brightened until the brilliant spectacle was presented of two suns shining together in the eastern horizon. Gradually the true sun seemed to eclipse its double, and when the obscuration was complete the splendid pageant had vanished. Had the sun been higher in the heavens we should doubtless have had a fine display of parhelia, or mock suns, in which the sun is surrounded by circles and arcs of circles, and two, three, five or seven images are seen where the bands touch the coronæ.

Parhelia are very common in high latitudes and have been described by all Arctic travelers. They have also been mentioned by Aristotle, Pliny and other ancient writers. Pliny, not to be outdone, says that stars have been seen surrounding the sun at mid-day. Parasalenæ, or images of the moon, are also seen under similar circumstances as the parhelia, and are doubtless produced by the same causes.

BOOK NOTICES.

BURR'S LIBRARY INDEX. Quarto, pp. 320. Half Russia. J. B. Burr Publishing Co., Hartford, Conn. $3.50.

When attending college, some twenty-five years since, we deemed Todd's Index Rerum an invaluable aid in recording and classifying items of various kinds picked up in our reading. Since that day we have adopted several plans of our own for preserving for subsequent reference such matters of historical, political and editorial value as we considered might be found useful in our work. Many an hour of tedious searching has been saved by this, and many a tedious hour has been spent by us in searching for some article or passage which would have been found in five minutes if we had taken the pains at the proper time to enter its page and volume in our Index.

The Burr Publishing Company has brought out a "Library Index" which is far superior to anything of the kind we have ever seen, and which will be found of the greatest value to ministers, teachers, editors, authors and all others who cannot store up in their memories all that they read and who are compelled frequently to look up facts for comparison and generalization in their respective vocations. We have been accustomed in our editorial work to keep memoranda of valuable and important articles found in our exchanges in a blank book with

an ordinary index cut in the side. We have also adopted the plan of cutting out and preserving within easy reach the printed indexes of such exchanges, so that when we desired to cram for a certain subject we could look up all that had been published in any of them without much trouble. But it will be seen that either of these plans is troublesome and unsatisfactory, while the use of Burr's publication, with its double and treble indexes, saves a great part of the labor and gives just what is needed, in a classified and condensed form, and preserves it in a handsome volume, easy to handle and an ornament to any book-shelf or library table. A very good description of this work is further given in our advertising columns.

THE PROBLEM OF HUMAN LIFE. By A. Wilford Hall: Octavo, pp. 524. Hall & Co., New York, 1880. $2.00.

This work is offered as an explanation of the quality and operation of the life principle on the basis of its assumed necessary substantiality, as an annihilation of evolution, and as a destructive review of Darwin, Huxley, Tyndall, Haeckel, Helmholtz and Mayer. Several chapters are devoted to a consideration of matter, substance, force, life, mind, soul, spirit, God. The fifth and sixth, constituting more than one-third of the volume, to that of the Nature of Sound, and the remainder to Evolution.

The author writes succinctly and forcibly, and carries with him a kind of magnetism which attracts the reader if it does not convince him. His introduction contains the gist of his argument against a "theistic evolution," and it must be admitted that he meets those portions which he quotes of the statements of such writers as Dr. McCosh, Rev. Joseph Cook, etc., fairly and with great appositeness; charging that this view of evolution is the same as Darwinism, except that Darwin takes no account of God after the miraculous creation of the first simple form, while the theistic evolutionists claim that every variation of one species into another is produced and nurtured under the supervising direction of God's providence. He is aggressive in his manner, and ridicules Joseph Cook's physiological statements unsparingly, and at the same time sarcastically terms it "obsequious absurdity" in Dr. McCosh to admit that there is nothing antagonistic between spontaneous generation and a religious belief in the existence of God.

To give the reader a better idea of his theory of the forces that exist in man and nature analogous to those exerted by God himself and that possess a substantial, or, as he expresses it, an entitative nature, as opposed to an ethereal or impalpable form, we quote a brief passage from the first chapter: "And whenever we can grasp the thought that man is a dual being, possessing a double organism, the one structure being corporeal, visible, tangible, the other incorporeal, invisible, and intangible; and when we can further recognise the fact that man, through the aid of his senses, can really and truly extend his personal presence to a limited distance beyond that of his corporeal form, we can then conceive of

an infinite personality who may exist upon his throne in one part of the Universe, and whose all-pervading substantial or entitative attributes, analogous to our senses, but infinitely surpassing them, may make Him literally omnipresent, causing his actual being to extend through all extent."

This quotation gives, as well as any single passage can, a condensed statement of the author's theory of the Problem of Life, its origin, sustaining principle and connection with the future life; yet he denies that it is in any sense materialistic.

The chapters on the Nature of Sound were reviewed in these pages last year, and we find no reason to change our views then expressed, which were, in brief, that the experiments of the most learned, patient, pains-taking, catholic investigators of the world, repeated in every imaginable form and manner, and corroborated in each instance, are not to be given up until after they have been met and controverted by equally careful and successful experiments based upon other hypotheses, which has not been done so far. Our author may succeed in overturning evolution, but we do not think he has applied his lever at the right point this time. The book has its crudities and errors of logic, as all theoretic works are liable to have, but it has its corresponding attractions and will prove deeply interesting to popular readers of all classes.

JOHN SWINTON'S TRAVELS: By John Swinton. G. W. Carleton & Co., N. Y.; 12 mo., pp. 46, paper; 25c.

This little volume consists of "current views and notes of forty days in France and England," in August and September, 1880 The author states in his preface that his reasons for publishing them will be found by those who properly read them; but after reading the book with some care, if he had any other object in view than to glorify the civilization and republican institutions of France to the disparagement of his own country, we have failed to "read properly."

THE EDEN TABLEAU: By Charles Beecher. 12mo. pp. 163. Lea & Shepard, Boston, 1880; cloth, $1.50.

In this work we find what the author terms "an attempt at a more thorough and consistent application of the laws of analogic interpretation to one of the most interesting and vital portions of the Bible," referring to the Mosaic legend of Paradise. In his preface Mr. Beecher favors his readers with a concise but comprehensive review of the various ethnic religions, including those of the Chinese, Japanese, Brahmins, Persians and Egyptians, in all of which he points out the idea of the spiritual origin of all things—the priority of the spiritual world over the material. In metempsychosis, which was the belief of the majority of mankind and from which sprang all religions, he finds but a corruption of the primitive doctrine of a celestial pre-existence, which was the original faith of Israel, and which was bequeathed to the early Christians.

XUM

Discussing the priority of religions, he urges that faith in a primeval paradise, either terrestrial or celestial, or both, has been the universal heritage of man, recording itself not merely in uncial manuscripts, but in letters of stone and earth, big as pyramids and mountains, and perpetuated in arbitrary emblems and rites and sacrificial ceremonies, from age to age, among peoples the widest apart in locality, lineage and language; claiming, finally, that of all paradisaic legends, that of Moses is simplest, purest, most in accordance with good taste and most readily yields a consistent and lofty spiritual meaning under the application of the simple laws of analogy. It must be, therefore, presumptively the true one and studied with reverence as throwing light upon the mysterious question of the past history of the spiritual universe.

In the body of the book are taken up and analyzed successively the Garden of Eden as an emblematic whole, the Tree of Life, the Tree of Knowledge, the First Adam, the Second Adam, the Serpent, the Attack, the Examination, the Sentence on the Serpent, the Sentence on Man and Woman, etc.; closing with the Eden Tabernacle, the Cherubim, the Four Rivers, Comparative Theology. It is a remarkably suggestive book and will be a world of consolation to doubting Christians and a source of gratification and pleasure to all scholarly readers.

THE RELIGION OF ANCIENT EGYPT. By P. Le Page Renouf: 12mo. pp. 270: Scribner's Sons, New York, 1880. $1.50.

This work is made up of the Hibbert series of lectures for 1879, and is an account of the origin and growth of religion, as illustrated by the religion of ancient Egypt. The six lectures are on the following topics, viz: "The Sources of Information respecting the Ancient Egyptian Religion," "The Antiquity and Characteristics of Egyptian Civilization," "The Gods of Egypt," "Communion with the Unseen World," "The Religious Books of Egypt," "Henotheism, Pantheism and Materialism;" and no one can read them without being convinced that their distinguished author has given a vast amount of personal observation and study to the subject and has drawn conclusions that must be acceptable to the majority of thinkers.

Beginning with the ancient heathen writers, he traces the religious beliefs of the Egyptians, through the hieroglyphic writings as deciphered and translated by Champollion and his successors, the monuments of the Rameses, the tablets of Abydos and Saqâra, the transcriptions of Manetho, and the moral code of Ameni.

The conclusion seems to be that the religion of Egypt was not from the first the mere worship of brutes which strangers imagined it to be from its practices in the days of its decline; the worship of animals being a consequence only and not a foundation principle. The elements of it were a sense of the infinite and eternal, holy and good, governing the world, and upon which we are dependent —of right and wrong, holiness and virtue, immortality and retribution.

The author fails to find the impress of Egyptian influences upon Hebrew

institutions, or that any of the idolatries or superstitions of the Israelites were derived from Egyptian sources, and sustains his position on this point ably. The book will be found most interesting and instructive to the best scholars as well as to merely popular readers.

OTHER PUBLICATIONS RECEIVED.

Laboratory Notes from the University of Cincinnati, by Prof. F. W. Clarke and some of the members of his classes.—Studies of the Food of Birds, Insects and Fishes, made at the Illinois State Laboratory of Natural History, at Normal, Ill., by S. A. Forbes, Director.—History of the Leavenworth *Times*, by D. R. Anthony, proprietor.—Indications of Character in the Head and Face. Illustrated. By H. S. Drayton, A. M. Fowler & Wells, publishers, New York. 15c.—Catalogue of the Officers and Students of Marietta College, Ohio, 1880–81.—Seventh Annual Report of the Board of Control of the State Public Schools for Dependent Children, 1880: by Lyman P. Alden, Superintendent.—Circular of the State School of Mines, Golden, Colorado, 1880–81.—Hamilton College, Sixty-ninth Annual Catalogue of Officers and Students, 1880–81, from Prof. Oren Root, Jr., Ass't Professor of Mathematics.

SCIENTIFIC MISCELLANY.

KANSAS SCIENTIFIC SURVEY.

PROF. J. D. PARKER, KANSAS CITY, MO.

The Kansas Academy of Science, at their November meeting, appointed a Commission to memorialize the Legislature in reference to a State Scientific Survey. Two preliminary surveys under Profs. Mudge and Swallow have already been made. A considerable amount of work has also been done, under the auspices of the Academy of Science, whose results need to be gathered up and put in permanent form. The Academy of Science has nearly completed a determination of the plants of the State, a large amount of the work having been prosecuted by that veteran botanist, Prof. Carruth, without any remuneration. In the proposed survey would it not be most fitting to place the necessary means in the hands of Prof. Carruth to complete his determination of the flora of Kansas and prepare a herbarium of the plants of the State, as complete as may be possible, to be placed in the Capitol building? This work would form the crown of a life devoted with singular disinterestedness to scientific pursuits, and Kansas would honor a citizen worthy of being remembered. A complete herbarium of the plants of the State placed in the Capitol, would be a treasure which few States possess.

Prof. Mudge accomplished before his death a large amount of geological work for Kansas. The Mudge Cabinet, bestowed with princely liberality upon

the Agricultural College was a monument worthy of any geologist. All his papers read before the Academy were based upon original observation and research and were real and substantial contributions to science. Prof. Snow is many-sided, and has contributed to our scientific knowledge in several departments. His contributions to botany are valuable; he has given us a nearly complete catalogue of the birds of Kansas; he has made large determinations among the insects; he has determined the species of fish in the Kansas river at Lawrence, and has kept a meteorological journal covering many years, which is recognized and referred to by meteorologists everywhere. Prof. Popenoe has been a valuable co-laborer in entomology and his labors are full of promise. The Government has placed a full set of self-registering meteorological instruments under the charge of Prof. Lovewell, of Topeka, who is now keeping a valuable weather journal.

Prof. O. St. John has, during his leisure time, extending over two years, completed a stratigraphical survey of the geological formations from the mouth of the Kansas river to Manhattan. This work has been accomplished with all the accuracy and perfection characteristic of the United States survey, of which Prof. St. John has been the palæontologist. Prof. St. John was with Prof. Agassiz in his expedition to South America, and has had a wide and varied experience in scientific pursuits. Kansas would be fortunate indeed to secure his services as Director of the proposed scientific survey. Prof. Bardwell did something in the way of triangulation, and by his death science lost a most valuable worker. Prof. Kedzie before his death, and Prof. Patrick have both done something in the way of determination of soils and minerals. There have been other laborers in various departments, valuable auxiliaries in the prosecution of the work, whose services have been cheerfully rendered without reward. Aside from the two preliminary surveys, all of this work has been accomplished for Kansas without asking a dollar from the State, except in the bare publication of the results. If there ever was a society that has been abundant in labors, extending over more than a decade of years, whose services have been rendered "without money and without price," it is the Kansas Academy of Science. In view of all those disinterested services in the cause of science, an appeal from the Academy for the State to gather up these results, and carry forward the survey, will surely not be unheeded.

There are cogent reasons why Kansas should resume the State Scientific Survey at the present session of the Legislature. Should the survey be put off two years, until the next biennial session of the Legislature, it would seem almost like a calamity. Nothing would more powerfully attract immigration than to ascertain and make known the vast natural resources of the State. A thorough scientific survey appeals to and attracts the more intelligent classes so desirable in any State. Kansas has been a leader in many things, and she cannot afford to lose her prestige. In our civil war the fires of liberty burned the brightest on Kansas soil. She has a double land grant for educational purposes, and the school fund, when all the lands are sold, will probably aggregate ten millions of

dollars. She has passed a law creating institutes for the normal training of teachers in *every* county—a feature already yielding good results, which has attracted the attention of educators from other States. She is the first of all the states to put prohibition in the state constitution, making temperance the organic law of the land. Kansas cannot afford to lose her leadership among the states in the onward progress of ideas. New York has spent half a million dollars on her scientific survey, and has become known as classic ground throughout the scientific world. The thorough development of the coal fields of Kansas would pay the State the entire cost of a geological survey many times. There are vast deposits of lead and zinc in the southeastern part of the State which need to be explored thoroughly. No other State has such wonderful beds of gypsum as Kansas which occur in those portions of the State where it is needed. The strata lie like the leaves of a book laid on its side which is shaved off from its upper northwest corner to its under southeast corner. Over the edges of these outcropping rocks pour the rivers of the State with rapid flow in an eastern or southeastern direction. Here is a vast system of rivers whose capacity for hydraulic power is almost unlimited, and yet no engineering skill has revealed the latent forces which nature designed to be employed by man. With immense cotton fields on the South, mountains of iron on the Southeast, and unlimited deposits of precious ores on the West, with thousands of square miles of coal and an almost unlimited hydraulic power from rapidly flowing rivers, it would be a shame for Kansas very much longer to import her cotton fabrics from New England, much of her railroad iron from Pennsylvania, and her agricultural implements from other more enterprising communities. Several counties in the western portion of the State would be benefited vastly by a system of irrigation which a State survey could easily devise. The comparative excellence of the immense beds of limestone and freestone should be accurately determined. A careful analysis of soils in various portions of the State would not be without its benefits to the farmer. Kansas is a paradise for scientific explorers and she cannot afford to wait and let her finest fossils be carried off to enrich the cabinets of eastern institutions of learning. The bare freight on vertebrates alone sent to Yale College from Kansas and Colorado has amounted to as much as a thousand dollars a year. There is considerable probability that artesian wells would flow from the eastern dipping strata in the western portion of the State, where they are so much needed. Our knowledge of the rainfall of the State needs to be based on wider observations.

If a proper proportion of Kansas were planted in forests, which the fostering hand of the State can accomplish, she would be for agricultural purposes the best, and soon the richest State in the Union. Her three greatest enemies would be subdued which now triumph over her more or less one after another from year to year. The State would not be subject to drouth, the grasshopper would cease to be a burden, and destructive winds would be driven into the upper regions of the atmosphere, and thus, as in all forest countries, pass over the State. The power of the terrible tornado would also be broken. A scientific survey for Kansas,

possessing a wider scope than ordinary geological surveys, should determine the kind of trees best adapted to different portions of the State.

Kansas has the greatest possibilities for good and liabilities for evil. The first can only be developed, and the latter averted by a knowledge of her resources and capacities resulting from a thorough scientific exploration. Such a survey would pay in a thousand ways. In prosecuting her geological survey, Michigan discovered her immense deposits of salt, which yield a revenue to the State annually of half a million dollars. And yet Illinois prosecuted her geological survey at an expense only of five thousand dollars a year, as such a survey calls forth almost an equal additional amount from benevolently disposed individuals and from the courtesies of railroad companies. Kansas cannot delay any longer her geological survey without great injury to the State. Nothing could grace the new wing of the Capitol building so well as a full collection representing the minerals and rocks, the fossils, animals and plants, of the State. Such a collection would present an irresistible attraction, and afford the materials for a thorough knowledge of the resources of the State which Kansas does not now possess.

IMPROVEMENT OF THE MISSOURI RIVER AT KANSAS CITY, MO., 1880.

The imperative necessity of checking the erosive action of the river in the bend above the city of Wyandotte, which so seriously threatened the safety of the Kansas City bridge and the levee front of this city, was brought to the notice of the government engineers in the fall of 1878. The Representative from this district placed the matter before Congress, which appropriated thirty thousand dollars for works of improvement designed to prevent the river from leaving Kansas City, with its bridge, inland. The appropriation became available in April, 1879, and work was immediately begun, in accordance with a plan laid out by Major C. R. Sutes, Corps of Engineers, U. S. A. The amount given being less than one-third what was asked to complete the work, and which it was contemplated should be expended in one year, it became necessary that the money be expended in constructing works of protection, leaving those of control to be completed at some future time.

The work done consisted in the construction of a "weed dyke," 650 feet long, and a continuous brush mattress, 5,042 feet long and 92 feet wide, with a thickness of about 6 inches—both devices being modifications, or improvements of such as had been used successfully in the rivers of India. These were built on the left bank above Wyandotte. The first was designed to deflect the course of the river, while the last, being laid along the bank, was intended to prevent further cutting. With their completion the appropriation was expended, and work suspended.

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The immediate effect was all that could be desired; a very considerable shifting of the channel was secured, the erosion checked, and the threatened "cut off" prevented.

During the next session Congress made a second appropriation of twenty-five thousand dollars for the continuance of the work in accordance with the original plan, which sum has not yet been expended.

With the opening of the river in the spring, active operations will be resumed. The general plan under which the work is to be done contemplates shore protection, and the development of new shore lines from Quindaro to Wyandotte, by the building up of bars and the straightening of the river on the crossings. Lengthening, rather than shortening of the river is designed, while the stream is to be kept within its present shore lines.

Attempts by corporations to control the Missouri river and improve it have been heretofore abortive, giving rise to the popular notion that the stream is beyond control, but the work done by the government during the past two years shows conclusively that the river can be improved, that permanent shore lines can be secured and a permanent channel maintained, and this at a trifling cost, when its importance is considered.

The United States engineer now stationed here, Mr. J. W. Nier, in pursuance of orders received by him from the Government, will at once proceed to construct two scows to be used in the Missouri river improvement, in the bend above Wyandotte, the coming season. The boats are to be about 100 feet in length and 22 feet wide, and will be built at the Wyandotte levee. The machinery for the boats is now on the way. Each craft will be outfitted with a large boiler thirty feet in length, weighing sixteen and a half tons, a compound Worthington duplex grading pump, a pair of shears and a steam capstan.

The Worthington pumps have been used with success at Omaha and other places. With an ordinary head of steam 750 gallons of water are discharged per minute. This stream thrown against a bank will remove more earth in a given time than 200 laborers. Last year, on account of the scarcity of labor and the refusal of men to work at the prices paid, work on the river improvements was for a time suspended. By means of the new appliances the engineers will be rendered comparatively independent. The cost of grading will also be greatly lessened.

It is expected that the boats will be completed within three months, and that the work done in 1881 will not only be preventive, but fully and permanently protective.

THE ALMACANTAR.

S. C. CHANDLER, JR.

I desire to call the attention of practical astronomers to a new instrument for the determination of time and latitude, the principles of the construction of which are, I believe, novel, and which seems to possess advantages entitling it

to consideration. From the results attained with an experimental instrument, which has been very neatly constructed for me by John Clacey, of this city, I feel justified in claiming that in accuracy, efficiency and convenience, this construction, for moderate-sized instruments, is superior to the transit instrument, while it is very much cheaper. The principle involved is the same as that of Kater's floating collimator for determining the zenith point of a graduated circle. Beyond this, however, there is no resemblance.

The following brief description of the instrument may be easily understood, by reference to the illustration. It consists of a heavy base, with approximate leveling screws at the corners, from the center of which arises an upright cylindrical pillar surmounted by a cap of hard brass, and encircled at the middle and base by brass collars. These serve as the bearings for a hollow, brass sleeve, fitting closely to the pillar and turning smoothly upon it. This sleeve is provided with a cross-head and lateral, diagonal braces which support a shallow trough in the form of a hollow rectangle. In this trough is contained mercury to the depth of about one-eighth of an inch, upon which swims a float of wood or iron, also in the form of a hollow rectangle, a little smaller than the trough. By means of two pins, projecting from the sides of the trough and playing in vertical slots in the sides of the float, the latter is kept in place, while it is free to seek its equilibrium. From the middle of the inside edges of the float project two bent arms of brass, the lower ends of which support the horizontal axis of the telescope. The axis is provided at one end with a clamp, and at the other end with an illuminating contrivance, and the telescope has a reticule of five horizontal spider lines.

If the telescope is turned on its axis and clamped at any desired altitude, and the whole instrument revolved around the upright axis, the sight line will describe a small circle in the heavens, parallel to the horizon. It is evident that the transit of stars, as they rise or fall over this horizontal circle, may be observed, and will furnish the means of finding the clock error, and also the latitude by a proper selection of the stars in different azimuths.—*Science Observer.*

KANSAS UNIVERSITY SCIENTIFIC NOTES.

Last summer, Prof. Snow, in company with Mr. L. L. Dyche and Miss Anna Mozley, spent four or five weeks in Santa Fe cañon, N. M., collecting beetles, moths and plants. It was in a country that had never been explored with a similar purpose, and a rich harvest was obtained. Several thousand specimens were brought home. Of those only the *Coleoptera* have been examined and twelve new species have been found. Of one of these Dr. LeConte, late president of the American Academy for the Advancement of Science, writes, that it is "the most extraordinary addition to our fauna that has been made for a long time," and the Doctor is usually sparing of adjectives. Speaking of the Colorado expedition two years ago, Prof. A. R. Grote says: "Such labors have a permanent

value in the field of Natural History in America and their continuance is greatly to be hoped for in the interest of science." In addition to this both LeConte and Horn have described several of the new species for the Kansas Academy of Science, an honor never before granted to Kansas.

The University does well to encourage scientific research, and the State should feel proud of the men who are bringing Kansas to the front in the realm of science. Professors B. F. Mudge, F. H. Snow and G. E. Patrick are prominent in the company. Prof. Mudge has ceased his labors, but the others are carrying the work on with enthusiasm that has and will merit success.—*Lawrence Journal.*

EDITORIAL NOTES.

SINCE the last regular meeting of the Kansas City Academy of Science our citizens have had the rare pleasure of a lecture by the well known artist, Col. James Fairman, of Chicago, upon the "Study of Fine Art." It was an eloquent, discriminative and classical effort—one of the most instructive and entertaining lectures yet offered our people under the auspices of the Academy. It is hoped that Col. Fairman may return here and deliver his full course.

THE Historical Society of New Mexico, which was organized in 1857 and flourished until the commencement of the war of 1861, when it died out on account of the dispersion of its members, has lately been revived and reorganized, with acting Governor W. G. Ritch for President; Judge L. B. Prince, Vice-President; David J. Miller, Corresponding Secretary; Wm. M. Berger, Recording Secretary; Lehman Spiegelberg, Treasurer, and J. C. Pearce, Curator.

Mr. Miller informs us that "while dormant its excellent and valuable collection of Spanish, Mexican and Indian relics, curiosities and remarkable natural productions of New Mexico disappeared irrecoverably. There is a fine field (he says) open to us yet, however, and I am sure the reorganization will duly utilize it in the acquisition and preservation of interesting and valuable information within and concerning historic old New Mexico."

FROM the report of the annual meeting of the Davenport Academy of Science, held Jan. 5, 1881, we learn that this best known of Western institutions has been in operation for thirteen years, owns its building, has about 4,000 volumes in its library, thousands of mound relics in its cabinets, comprising inscribed tablets, tools of copper, flint implements, etc., etc., besides geological and mineralogical specimens in great abundance. Its principal officers and J. Duncan Putnam, President; Dr. C. C. Parry, Corresponding Secretary, and C. E. Putnam, Treasurer.

PROF. F. E. NIPHER, the distinguished physicist of Washington University, St. Louis, has sent us his beautiful photographic map of Equal Magnetic Declinations, prepared from the numerous and laborious magnetic surveys made by him during the past three years. It is a wonderful example of patient and skilled scientific labor on his part, and the results will undoubtedly be a great surprise to all who examine it.

At the St. Louis Academy of Science, on the 19th ult., Prof. Nipher displayed a plaster cast of a *raised* map of the State of Missouri, showing the magnetic lines in *bas relief* on a scale of twenty miles to the inch in the area of the State. This, he informs us by private letter, it is his intention to have photographed, or artotyped, and sent to various portions of the State for sale.

They will be found very interesting to all and very valuable to many of our citizens, and we bespeak for him a liberal patronage. Though Prof. Nipher has made these surveys at his own personal expense so far, it is believed that by proper effort on the part of intelligent citizens of the State the Legislature may be induced to make the necessary appropriation to finish this important work, which will require about three years longer.

We learn from the Catalogue of officers and students of Washburn College, Topeka, Kansas, for 1880–1, that there are 132 students of all grades, that the faculty is fully and comprehensively organized, that the curriculum of study is arranged with a view to a broad and liberal culture, in aid of which there is a choice library, a well equipped laboratory and cabinets of minerals, an assaying department, and very complete outfit of meteorological instruments. The college is not conducted in the interest of any religious denomination, but has for its object the promotion of the highest and best culture—mental, moral, social and religious.

We are indebted to Mr. E. E. Richardson, assistant Secretary, for a copy of the tenth annual live stock report of the Kansas City Stock Yards, by which it appears that the increase in the number of cattle handled in the ten years is from about 121,000 to over 244,000; in hogs from about 41,000 to more than 676,000; in sheep from about 4,500 to nearly 51,000, and in horses from less than 900 to over 14,000.

We present herewith a table showing the degree of cold here on the coldest day of each January since 1875:

	Jan.	7 A. M.	2 P. M.	10 P. M.
1875	9	−18°	9°	−5°
1876	10	11°	20°	20°
1877	16	−12°	5°	4°
1878	6	7°	18°	12°
1879	3	−14°	−5°	−7°
1880	30	23°	27°	25°
1881	9	−7°	4°	2°

The Kansas City Electrical Society, recently organized, is a valuable acquisition to the list of scientific and social organizations of the city. The objects for which the society was formed are for the practical and the theoretical study of electricity, the examination and study of electrical apparatus and appliances. The following officers have been elected for the first year:

President, W. H. Woodring; Vice-President, T. F. Clohesey; Secretary, J. J. Burns; Treasurer, G. M. Myers; Executive Committee, Messrs. W. H. Woodring, J. J. Burns, Dr. Joshua Thorne, M. D. Wood and W. C. Stewart.

Capt. Howgate writes, Jan. 22d: "The outlook for the continuance of work in the direction of Lady Franklin Bay this year is quite encouraging. Dr. Rae writes me that there is a prospect of English arctic work via Franz Joseph Land, but it will not be done before 1882. All the European countries interested in Arctic matters are awaiting the result of our labors here. If we succeed, there will be no lack of foreign followers."

ITEMS FROM THE PERIODICALS.

It is wonderful how rapidly, though almost imperceptibly, a man who takes the leading periodicals of the country can build up a large and valuable library. Being crowded for space in our book shelves lately we were almost surprised to find so many volumes of *Harper's Monthly*, *North American Review* and *Atlantic*, all of which we have been receiving almost continuously for more than twenty-five years, except the latter, which has not been published quite so long. In these volumes can be found an epitome of all that has transpired in the literature, art, biography and science of the world during all that period, as well as reproductions of what has occurred in the past in these departments. A man in any avocation requiring constant reference to the labors of others, for instance an editor, could better afford to lose all the rest of his library than such volumes as these and a few other similarly comprehensive periodicals.

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THE *Princeton Review* for January presents its usual massive array of original articles. That of Prof. William G. Sloan upon "The Public Schools of England," and of Dr. George P. Fisher, of Yale College, upon "The Historical Proofs of Christianity," being a consideration of the miracles of Christ, are the most attractive and readable in a popular sense, without the least disparagement of any of the others. This magazine is now in its fifty-seventh year, and is published in bi-monthly numbers of 148 pages at only $2 per annum.

HAVING arranged clubbing terms with the *North American Review*, we are enabled to offer that foremost of American periodicals, together with the KANSAS CITY REVIEW, at the low price of $6 per year. The *North American* is the organ of the best minds of America, nearly every writer of note in the country being a contributor to it. It discusses the subjects that are most prominent in the public thought at the time, and presents both sides of all important questions. It combines to a considerable extent the thoroughness of the Cyclopædia with the timeliness of the daily paper. It should be read by the professional man, the student, the merchant, the manufacturer, the farmer; in fact, by every one who wishes to form intelligent opinions on the events of the day.

NUMBER 17 of the *Humboldt Library* presents this month one of the best of Herbert Spencer's works "Progress"—one which every intelligent person can read with pleasure and profit, whether he adopts the peculiar views set forth or not.

The selections so far made by the editor of this popular series have been unusually judicious and well varied, having comprised geology, astronomy, metaphysics, education, natural history and physics. Six more numbers will be included in the first year, which, when bound together, will make a most valuable and comprehensive volume for the price.

THE *Phrenological Journal* of New York is the only periodical devoted to the subject, and it includes with this all that relates to Human Nature and the improvement of men physically, mentally and morally. In the prospectus of 1881 the publishers make liberal propositions to subscribers. The price has been reduced to two dollars a year, and to each subscriber is offered a new phrenological bust.

CAPT. F. M. POSEGATE, a prominent citizen and postmaster of St. Joseph, Missouri, recently delivered a lecture at Maryville upon the "Lights and Shadows of Life," of which the *Republican* of that place speaks in the highest terms as "a beautiful picture drawn with delicate fineness and a keen insight into human nature."

PROF. C. V. RILEY, who has been added recently to the editorial corps of the *American Naturalist*, writes that he has a few sets of the *Entomologist* to spare, which he will sell at $1,50 per volume, post-paid.

The Age of Steel, formerly the St. Louis *Journal of Commerce*, is one of the oldest commercial and manufacturing papers in the West, being now in its forty-ninth volume. It is also one of the best, and we have frequently availed ourselves of information derived from its columns in working up matter for the *Review*. It is published in St. Louis and furnished to subscribers at $3 for the weekly edition and $1 for the monthly edition.

WE have reeeived "Annual Reviews" from a number of sources, showing commendable enterprise on the part of editors of Western papers and wonderful growth in Western cities. Most prominent among these are the *Commercial Indicator* of Kansas City, the *Daily Bee* of Omaha, Nebraska, and the *Tribune*, published at Denver, Colorado.

Each of these papers is a marvel of good printing and laborious, accurate and valuable editorial work, creditable in every respect to its proprietor and certain to be of inestimable value to the city and district whose business growth and importance it publishes to the country.

AMONG other newspapers offering to club with the REVIEW is the Boston *Journal of Commerce*, one of the very best commercial papers in the United States, a very large, handsome weekly, filled to overflowing with market reports from all over the world, mining news, the latest inventions and improvements in machinery, technology, etc., etc. The regular price is $3 per annum, but to any subscriber to the REVIEW we can furnish it for $2.40, post-paid.

THE article by our fellow-citizen, James Taylor, Esq., on "Our City Sewerage," in the *Journal* of Jan. 8th, was a plain, practical paper, full of excellent suggestions and worthy of the careful consideration of the City Council and of all property owners putting drain pipes into their houses.

It is conceded by the best medical authorities that disease is bred and fostered in an atmosphere poisoned by sewer gases, and we cannot be too careful to avoid them.

The Kansas City Review of Science and Industry

Enters upon its fifth year with the May issue, 1881, and is offered to the intelligent people of the country as an exponent of Western thought and a medium of communicating Western discoveries, inventions and theories.

64 PAGES, LARGE OCTAVO. $2.50 PER ANNUM: SINGLE NUMBERS 25c.

The REVIEW numbers among its CONTRIBUTORS some of the most earnest and capable workers and thinkers in the West, as well as many Eastern scientists of prominence, and has been highly commended in all directions, for the freshness and originality of its articles and the promptness with which it publishes new discoveries and inventions.

CONTRIBUTORS WITHIN THE PAST YEAR:

Prof. G. C. Broadhead, late State Geologist of Mo.
Prof. G. C. Swallow, of the University of Missouri.
Prof. F. H. Snow, of the University of Kansas.
Prof. E. A. Popenoe, State Agricultural College, Kas.
Dr. F A. Ballard, Independence, Mo.
Rev. L. J. Templin, Hutchinson, Kansas.
Prof. E. L. Berthoud, Colorado School of Mines,
Prof. H S. Pritchett, of the Morrison Observatory.
William Dawson, the Quaker Shoe-maker Astronomer.
Prof. A. J. Conant, St. Louis, Missouri.
Prof. T. B. Smith, Louisiana College, Mo.
Prof. F. W. Clarke, of the Cincinnati University.
Prof. F. E. Nipher, of the Washington University.
J. A. Smith, Paola, Kansas.
Mrs. M. W. Hudson, Topeka, Kas.
Prof. J. M. Long, Richmond, Mo.
Dr. Ivon D. Heath, Wyandotte, Kas.
Rev. T. L. Lewis, Bolivar, Mo.
Edgar L. Larkin, New Windsor, Ill.
Sam'l J. Wallace, Silver Cliff, Col,
Prof. E. T. Nelson, Ohio Wesleyan University.
A. L. Child, M. D., Plattsmouth, Neb.
Prof. Jno. B Dunbar, Deposit, N. Y.
Prof. J. T. Lovewell, Washburn College.
Dr Chas. H. Sternberg, Ellsworth, Kas.
Prof. S. H. Trowbridge, Glasgow, Mo.
Prof. S. A. Maxwell, Morrison, Ill.

Hon. R. T. Van Horn, Kansas City, Mo.
Prof. John D. Parker, " "
Prof. George Halley, M. D., " "
V. W. Coddington, " "
Robt. Gillham, C. E., " "
W. W. Alexander, " "
Dr. W. A. Browne, " "
Prof. E. C. Crosby, " "
Ermine Case, Jr., " "
W. H. R. Lykins, " "
Dr. R. Wood Brown, " "
Dr. W. B. Sawyer. " "
John Fee, M. D., " "
W. H. Miller. " "

Of Eastern Scientists who have, during the past year, contributed to the REVIEW, we may mention Prof. H. C. Bolton, Trinity College, Hartford, Conn.; Prof. C. V. Riley, Washington, D. C.; Dr. S. W. Williston, New Haven, Conn.; Capt. H. W. Howgate, U. S. A.; Isaac P. Noyes, Rhode Island; Prof. O. T. Mason, Columbian College; Prof. John Rae, F. G. S., London, England; M. F. Connor, Paris, France.

We have determined to continue the plan which proved so appropriate and acceptable last year, for giving premiums to our subscribers, viz.:

To any person who sends us $3.50 we will send the REVIEW for one year, and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co., Robert Clark & Co., Houghton, Miffiln & Co., Harper Bros., Roberts Brothers, J. B. Lippincott & Co., John Wiley & Sons, Henry C. Lea, S. R. Wells & Co., Ivison, Blakenan, Taylor & Co., Orange, Judd & Co., etc.

To any one sending us $3.75 we will send the REVIEW for one year and any $2.00 book published by any of the above firms.

Persons desiring to subscribe for the REVIEW and purchase any book or books, or subscribe for any other periodical, published or obtainable in this country, can obtain special rates by applying to the editor in person or by letter.

Clubs desirous of subscribing for the REVIEW can have the same privilege as single individuals, besides the advantage of reduced rates of subscription.

To persons who wish to purchase law, medical, scientific or miscellaneous books, and at the same time subscribe for a periodical which includes within its scope popular articles upon all branches of science, mechanical arts and literature, we deem this a particularly favorable offer.

BACK NUMBERS.—To any subscriber for the fifth year we will furnish the back numbers of the first and second year for $2.25 each set, bound, or $1.25 each, unbound; and of the third and fourth years at $3.00 each, bound, or $2.00 unbound.

As the fourth volume of the REVIEW will close soon, and we shall be asking our friends to renew their subscriptions, it may be well enough, by showing the estimation in which it is held by scientific men and periodicals in different parts of the country, to publish extracts from some of the encouraging letters and notices we have recently received. From them it will be observed that the REVIEW has met with favor not less in the East than in the West, and even in Europe it has found some readers of note who have been kind enough to express their appreciation of it and its management:

University of the State of Missouri,
Columbia, Mo., May 13, 1879.

THEO. S. CASE, Esq.:

MY DEAR SIR: I can but congratulate you on the excellence of your journal, and I will try and aid you with an occasional article,

* * * * * * *

Yours truly,
G. C. SWALLOW.

Prof. O. T. Mason, Columbian College, D. C., the distinguished anthropologist, writes:

"I have frequently promised myself the pleasure of showing my appreciation of your very creditable journal by sending you something from the foreign field, &c."

Boston Scientific Society,
January 31, 1879.

With thanks for kindness in sending your REVIEW to our Society, and congratulations upon the high standard it has reached, I am,

Ever yours,
J. RITCHIE, JR., Sec'y.

Osage City, Kansas.

I am much pleased with the articles in the number before me, and I deem it a better work for the general reader than most of the scientific journals of the present day.

Yours, &c., J. W. JACKSON.

New York, October 8, 1879.

I have offered to send the REVIEW to the library of the Metropolitan Museum of Art, of which Gen. L. P. di Cesnola is director, as its archæological papers will there be appreciated, and would like, therefore, a full set from the commencement.

Very sincerely,
DR. F. A. CASTLE.

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* * * The REVIEW is a very useful publication, and must contribute very sensibly to the material development of this section of the country, a record of whose history and development it is the object of the society to make up. Yours very truly,
F. G. ADAMS,
Sec. Kansas Hist. Society.

Washington, Jan. 20, 1879.

* * * * * * *

I look upon your REVIEW as a very valuable addition to scientific journalism, and one especially interesting to the growing West.

Very truly yours,
H. W. HOWGATE, U. S. A.

PROFESSOR WILLIAM H. WAHL, of Philadelphia, associate editor of the *Engineering and Mining News*, published in New York City, writes, August 5th, as follows: "* * * * I take much pleasure in reading your REVIEW, and trust that you are succeeding with it."

There are several other articles by home and Western authors, which keep up the peculiarly distinctive character of the magazine as the organ of Western thought, while its miscellany is of the latest authority and choicest character. We grow more and more proud of our home publication.—*Kansas City Journal.*